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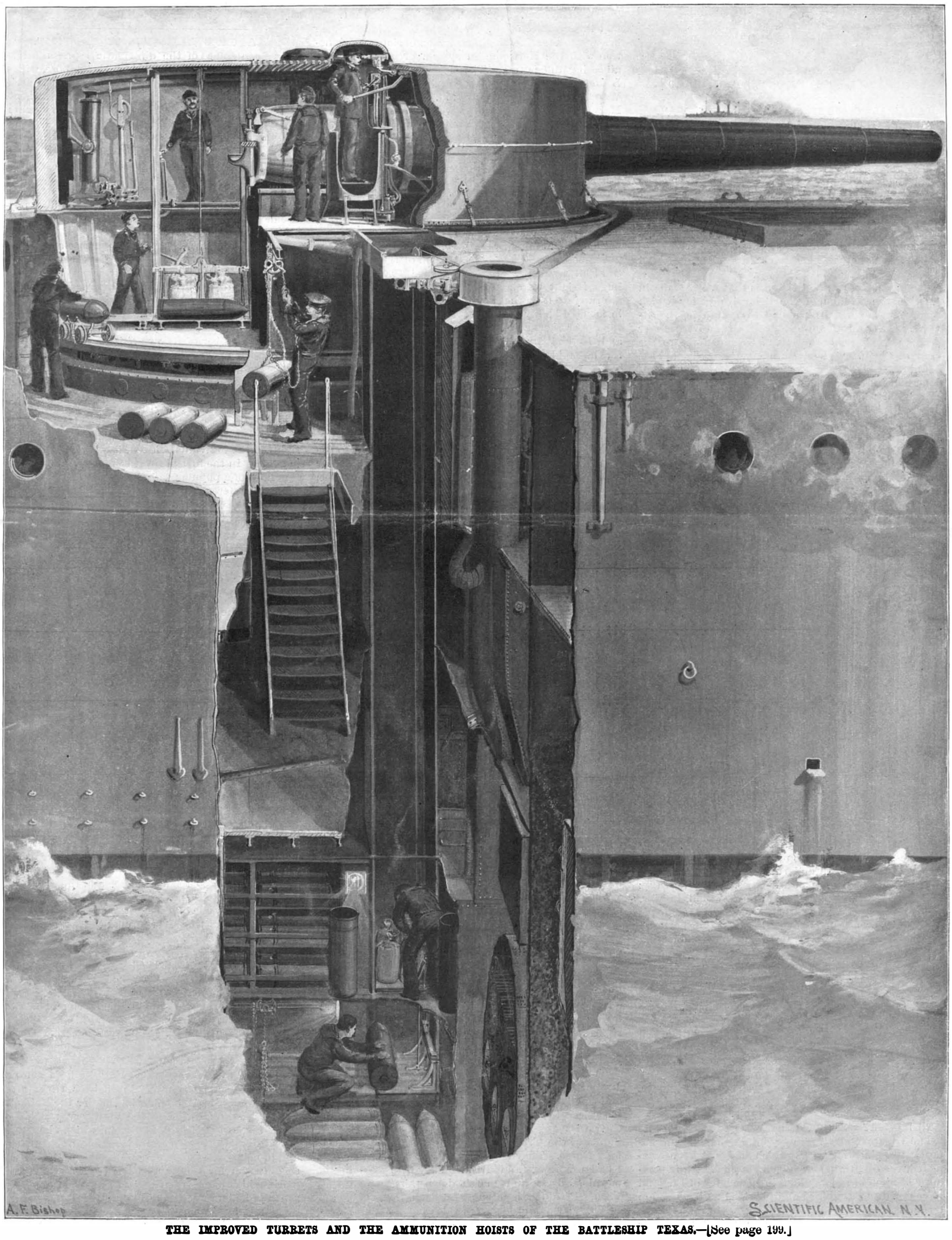

THE IMPROVED TURRETS AND THE AMMUNITION HOISTS OF THE BATTLESHIP TEXAS.—[See page 199.]

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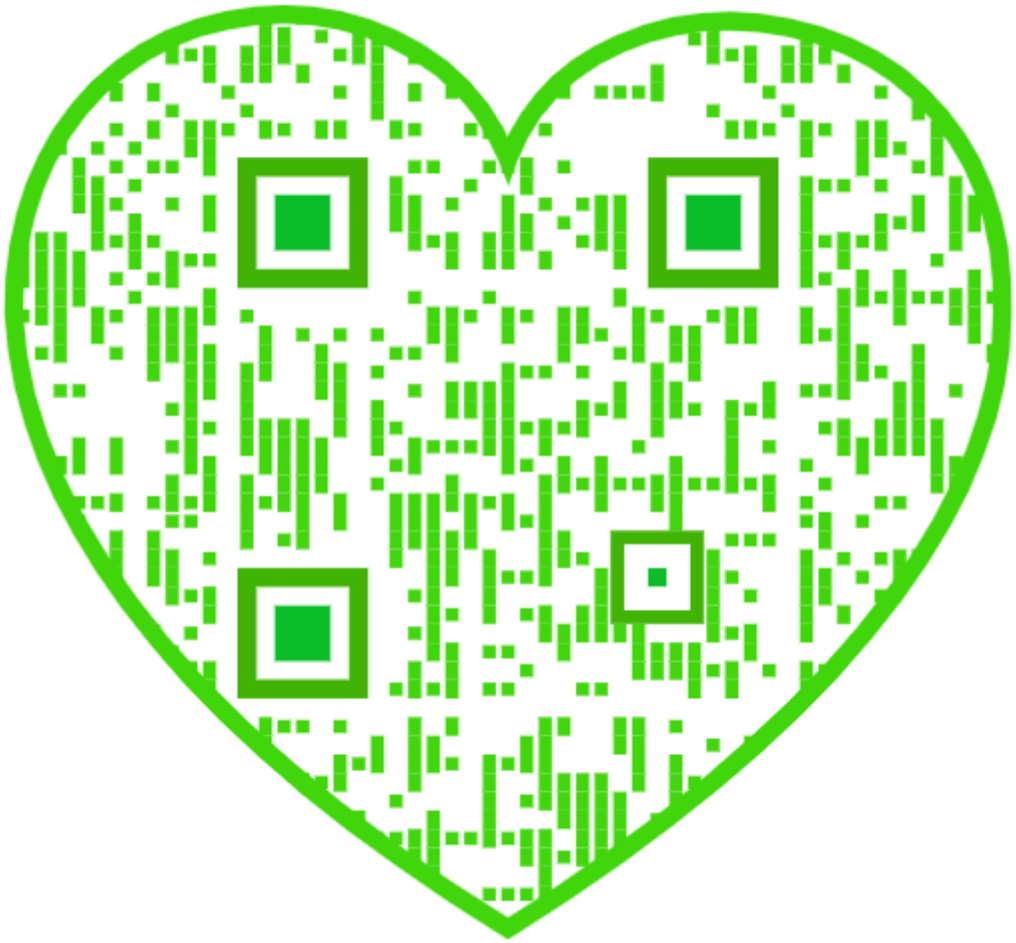

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NEW YORK, SATURDAY, APRIL 1, 1899.

ADMIRAL COLOMB ON THE SPANISH WAR.

Admiral Colomb, who is the literary Mahan of the British navy, has lately contributed a paper to the Royal United Service Institution, entitled "The Lessons of the Spanish-American War." The conclusions of the admiral are quoted and discussed at considerable length in a recent editorial in Engineering, which is reprinted in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT. We commend the article to our readers as forming a comprehensive expression of expert opinion on the part of the people who more than any other have reason to be interested in the technical results of the war.

The most important criticism is that which calls in question the wisdom of the defensive policy which largely characterized our naval campaign in the Atlantic. Admiral Colomb considers that our proper strategy was to send at once an adequate force to the coast of Spain. "The seizure of Minorca as a base would probably," he says, "have been an easy operation; and in any case it would have been morally certain that if this action had been taken, nothing offensive on the other side of the Atlantic could have been thought of by Spain." In view of the pitiful unpreparedness and incompetence of the Spanish navy, Admiral Colomb is undoubtedly correct; but no one knew at the outbreak of the war that the Spanish ships could not make half their trial speed or that Spanish gunners could not hit anything. It is easy to be wise after the event. The Spanish fleet on paper was too formidable in strength and numbers for our fleet to be able to seal it up in the home ports; and, by placing the theater of the war on this side of the Atlantic, we placed upon the enemy all the onus of the coal supply question—a consideration, by the way, that primarily led to Cervera's premature undoing.

Admiral Colomb is the father of the naval policy whose creed is that the best and most economical coast defense is a fleet of ships blockading the enemy's ports. Hence we are not surprised that he condemns the "sort of panic" which seized the people of the Atlantic coast and led to all the inconvenience of closed harbors and mined channels and waterways. While the panic was certainly uncalled for, the wisdom of closing our harbors was undoubted; for, even if we had blockaded the Spanish coast, it was reasonable to suppose at the time that our ships were too few to absolutely prevent the escape of some of the faster cruisers, any one of which might have wrought havoc in unprotected harbors. We know now that, even if some Spanish ships had escaped, they would have been comparatively harmless; but we did not know it then, and our conservative plan of campaign was justified by existing circumstances.

Admiral Colomb believes that ships are better than batteries. Ships will be too much engaged in hunting ships to take the time and run the risks involved in entering harbors to bombard cities. Thus he says: "No naval officer with his hands free would, in war, proceed into New York Harbor in order to damage New York, even if he believed there were no batteries and no mines to prevent him." To this Engineering makes the pertinent reply that we find an instance of the effect of the possibility of bombardment in the Manila campaign, when Admiral Dewey silenced the batteries at Manila by a threat of bombarding, not the batteries, but the town, if his ships were molested.

Except in the case where a country has an enormous navy in proportion to the length of its coastline and the exposure of its seaboard cities, a certain amount of coast defenses is not only advisable but imperative—imperative if the navy is to be set free to do its legitimate work of hunting down and destroying the enemy's ships.

THE GREAT CENTRAL RAILWAY OF ENGLAND.

The Great Central Railway of England is an important engineering work which has just been completed, the first train starting on March 9. An important collection of railway lines in the center of England have now been combined and provided with a London terminus. Since 1868 no new railway from the north has entered into London, and in thirty years the growth and development of England, and even London itself, would really seem to necessitate the venture. The old Manchester, Sheffield and Lincolnshire system from a provincial east and west line now takes its place among the great north and south trunk systems, giving what, under existing conditions, would appear to be the last important through route which can be added to the railway facilities of the metropolis. The Great Central system quietly extended itself southward to meet the gradual northward progress of the Metropolitan Company. When Annesley was reached the directors boldly announced their intention of securing access to London independent of the Great Northern system, over which their southern traffic had hitherto been sent. With the exception of some heavy work at Nottingham, the extension to a junction with the Metropolitan system presented few engineering difficulties. The new railway comes into London by way of Willesden Green and St. John's Wood, and the terminal station, to be known as the Marylebone Station, is just west of Regent's Park, and is located on the Marylebone Road. Thirty-seven acres were required for the terminal. The passenger station site has an area of nine acres, and is 1,000 feet long and 435 feet wide. Of this, a section 180 feet in width will, for the present, be occupied by three platforms and five lines of tracks. No attempt has been made to produce a particularly expensive station, but it is in excellent taste, as it is purely an engineering work, and is not covered with sham architecture. The large terminal hotel is, however, very handsome. It is probable that the London extension of the Great Central Railway will cost altogether some $50,000,000. The huge freight warehouse is 385 × 255 feet. The cars are run into it on the ground level, and they can then be lowered bodily by elevators into the basement, and the upper floors are provided with cranes. Hydraulic and electrical appliances are used throughout the yard for the rapid moving of freight.

NEW YORK TRUANT SCHOOL.

In New York city, or, more properly speaking, that portion of it termed the Borough of Manhattan, the rules of the Board of Education regarding truancy are strictly enforced, and education is truly compulsory. Those who persist in playing truant are sent to the Truant School, in East Twenty-first Street, where, for two or more weeks, the boy is detained as a prisoner; but he is a prisoner only in name, for, while it is true the door is locked, there are no bars nor anything else which suggests a reformatory. There are twenty-two men and two women employed in the borough as truant or attendance officers. They investigate the cases of truancy reported by the principals of the schools, and visit the parents of the children and try to get the parents to co-operate in seeing that the pupils attend school regularly. If this is unavailing, it is the duty of the attendance officer to take the little offender to the Truant School, where the acting superintendent decides whether or not he shall have another chance, for the boys are committed to the school only as a last resort. When a boy begins to absent himself from school, he is caught by the officer, asked the reason, and reprimanded. Then the attendance officer calls on his parents and reads them a copy of the compulsory education law. If this fails to make the boy a regular attendant, he and one of his parents are summoned to a private hearing before the superintendent. Every case is carefully considered, and if there seems to be an antipathy between the teacher and the boy, he is transferred to another school. Sometimes these persuasive tactics are not sufficient. Then the boy is put on probation for two weeks, and he must bring in a card to the superintendent, showing that he has been a regular attendant at school and his conduct has been good. If the small truant persists, however, in pursuing his rebellious career, there is nothing that can save him from incarceration in the Truant School.

The boy is kept in the Truant School at the expense of the city for two weeks or more, and this time can be extended to even six weeks if necessary. When a boy leaves the Truant School he is put for two months on parole. During that time he must report at regular intervals to the superintendent. If his conduct has been excellent, he is allowed to drill on Friday evenings with the truants. The work which has been done in the truancy school is very remarkable. The boy is taught by kindness and appeals to his moral nature, and there are no cases that sooner or later do not yield to all the influences to which they are subjected.

The building itself does not call for special attention. It was built originally for the Children's Aid Society, and is only fairly well adapted to the purpose. The boys sleep in dormitories, and to some of them it is their first experience in sleeping on a bed, for the pupils of the Truant School are cosmopolitan to the last degree. They include Americans, Italians, Poles, Russians, Jews, and Irish. They rise at 6 in the morning, dress and march downstairs, where they wash. Breakfast is eaten at 7 o'clock, then they make their own beds and do part of the kitchen work. At 8:30 they again wash and brush up for school. Then come various studies until 12 o'clock. From 1 o'clock until 3 o'clock the school is in session again, and they are then allowed to walk up and down for an hour in the little courtyard, for, unfortunately, the school is shut in by high buildings. They have supper at 5:30, and at 6:45 they have a regular military drill. Promptly at 8 o'clock the boys go to bed on their little iron bedsteads. So well are the boys treated that they very seldom think of escape, and if they do, a half hour in a dark but well ventilated closet will always bring them to terms. The work that has been done specially among the east side truants by the acting superintendent, Mrs. Alger, has been very remarkable, and shows what boys really need is a friend.

A GROSS VIOLATION OF PRINCIPLE.

At a conference of the diplomatic representatives of the Latin-American countries which compose, with the United States, the International Union of American Republics, recently held at the State Department, it was decided that the admission of advertisements in the publications of the bureau should be continued, and that all moneys received by the bureau from advertising, etc., should be paid to the Secretary of State for deposit in the Treasury of the United States to the credit of the bureau fund. It was also decided that the Executive Committee should have power to specifically authorize, if it saw fit, the solicitation of advertisements and the sale of the bureau publications by agents working on a commission.

It is impossible to mistake the purpose and effect of this compact. Its purpose is to increase the funds of the bureau by lending all the "drawing power" of the government to the advertising columns of what is practically a trade journal, and its effect is to set up the government in the publishing and advertising business in direct and disastrous competition with the interests of a certain number of its own citizens. In other words, the publishing and advertising interests find themselves in the anomalous and vexatious position of contributing to the support of a government which is using its powerful influence to capture the very trade upon which those interests subsist.

Now, anything more unconstitutional than this action of the bureau, or aiming more directly at the rights of the individual citizen, it would be difficult to imagine. In the first place, it is a flagrant abuse of the functions of a popular and representative government that the interests of one section of the community should be sacrificed for the enriching of another section.

The bureau already receives an appropriation to cover the expense of printing and publishing its literature, as do the other bureaus of the United States government. By what special favor, then, is this particular bureau allowed to enter into commercial enterprise and use the government name to fill its own coffers at the expense of the legitimate trade publications?

The violation of principle is extremely dangerous as a precedent for further legislation of the kind. If the Bureau of American Republics is justified in filling its coffers by dabbling in trade, why not the other bureaus? And if we had all the bureaus similarly engaged and reaping the inevitable profits, we should have the ridiculous spectacle of a trading and manufacturing people supporting a great rival concern (their own government), whose operations were eating the very heart and life out of their own industries.

We were willing to believe that the parties who have been responsible for this miserable piece of business had acted without looking at the question in all its aspects; and we fully expected that when its injustice had been pointed out, as it has been, in our own and many other journals, the bureau would act on the suggestion and discontinue its insertion of paid advertisements. It seems we were mistaken. The gentlemen who control the bureau find the ill-gotten gains too profitable to be so readily let go, and the recent compact at the State Department shows that we are still to be subjected to one of the most unblushing and extraordinary abuses that ever brought discredit upon a popular government.

GEOGRAPHICAL NAMES AS LEGITIMATE TRADE MARKS.

An interesting decision has recently been rendered, touching the protection obtainable at common law on the use, as a trade mark, of a geographical name pure and simple. The difficulty of procuring the registration of trade marks for this class of names is well known, and the difficulty has increased in recent years, the Patent Office protecting itself in the position it assumes in refusing to register trade marks coming under this denomination, under the claim that it has no option, owing to the statutory regulations. Many instances arise, however, in which the geographical significance of a term is remote or far-fetched, and in many cases some obscure town or place is cited as a reason for refusing the registration of a trade mark, which name is entirely unknown to the applicant, and almost entirely so to the public at large. Such a strict application of the statute often works hardship, and doubtless leads to many anomalous con-

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sequences. It sometimes places the department in the position of refusing registration for trade names which have been in use for many years, and which are so far recognized as commercial property as to be readily sustained in courts of law. All this leads one to hope for many radical changes in this feature of patent practice, and it is understood that remedial measures, with a view to unifying the statutory and common law practice, will be recommended in the bill which is being prepared with so much care by the commission having charge of the revision of patent and trade mark laws. No doubt any change in this direction will be welcomed by the officials in the trade mark department of the Patent Office and will enable them to follow in their ministerial duties the best rulings of our highest courts of law.

The case cited herewith is the American Waltham Watch Company vs. United States Watch Company.

MASSACHUSETTS: Supreme Judicial Court, March, 1899.

Holmes, J.: "This is a bill brought to enjoin the defendant from advertising its watches as the 'Waltham Watch' or 'Waltham Watches,' and from marking its watches in such a way that the word 'Waltham' is conspicuous. The plaintiff was the first manufacturer of watches in Waltham, and had acquired a great reputation before the defendant began to do business. It was found at the hearing that the word 'Waltham,' which originally was used by the plaintiff in a merely geographical sense, now, by long use in connection with the plaintiff's watches, has come to have a secondary meaning as a designation of the watches which the public has become accustomed to associate with the name. This is recognized by the defendant so far that it agrees that the preliminary injunction granted in 1890 against using the combined words 'Waltham Watch' or 'Waltham Watches' in advertising its watches shall stand and shall be embodied in the final decree.

"The question raised at the hearing and now before us is whether the defendant shall be enjoined further against using the word 'Waltham' or 'Waltham, Mass.,' upon plates of its watches without some accompanying statement which shall distinguish clearly its watches from those made by the plaintiff. The judge who heard the case found that it is of considerable commercial importance to indicate where the defendant's business of manufacturing is carried on, as it is the custom of watch manufacturers so to mark their watches, but, nevertheless, found that such an injunction ought to issue. He also found that the use of the word 'Waltham' in its geographical sense upon the dial is not important, and should be enjoined.

"The defendant's position is that, whatever its intent, and whatever the effect in diverting a part of the plaintiff's business, it has a right to put its name and address upon its watches; that to require it to add words which will distinguish its watches from the plaintiff's in the mind of the general public, is to require it to discredit them in advance, and that if the plaintiff, by its method of advertisements, has associated the fame of its merits with the city where it makes its wares, instead of with its own name, that is the plaintiff's folly, and cannot give it a monopoly of a geographical name, or entitle it to increase the defendant's burdens in advertising the place of its works.

"In cases of this sort, as in so many others, what ultimately is to be worked out is a point or line between conflicting claims, each of which has meritorious grounds, and would be extended further were it not for the other. (Boston Ferrule Company vs. Hills, 159 Mass., 147, 149, 150.) It is desirable that the plaintiff should not lose custom by reason of the public mistaking another manufacturer for it. It is desirable that the defendant should be free to manufacture watches at Waltham, and to tell the world that it does so. The two desiderata cannot both be had to their full extent, and we have to fix the boundaries as best we can. On the one hand, the defendant must be allowed to accomplish its desideratum in some way, whatever the loss to the plaintiff. On the other, we think the cases show that the defendant fairly may be required to avoid deceiving the public to the plaintiff's harm, so far as is practicable in a commercial sense.

"Whatever might have been the doubts some years ago, we think that now it is pretty well settled that the plaintiff, merely on the strength of having been first in the field, may put later comers to the trouble of taking such reasonable precautions as are commercially practicable to prevent their lawful names and advertisements from deceitfully diverting the plaintiff's custom.

"We cannot go behind the finding that such a deceitful diversion is the effect, and intended effect, of the marks in question. We cannot go behind the finding that it is practicable to distinguish the defendant's watches from those of the plaintiff, and that it ought to be done. The elements of the precise issue before us are the importance of indicating the place of manufacture, and the discrediting effect of distinguishing words on the one side, and the importance of preventing the inferences which the public will draw from the defendant's plates as they now are on the other. It is not possible to weigh them against each other by abstractions or general propositions. The question is specific and concrete. The judge who heard the evidence has answered it, and we cannot say that he was wrong." Decree for plaintiff.

William A. Munroe, Frederic P. Fish, and Frank L. Crawford for plaintiff; Oliver R. Mitchell and Causton Browne for defendant.

TESTING ACETYLENE GENERATORS.

There are four villages in this country lighted in part or entirely by acetylene gas, and a number of stores, factories, and hotels have installed plants having a capacity of about two hundred lights each, but nevertheless the principal development to-day is with that type of generator that is adapted and intended for the lighting of such places as dwelling houses, small stores, offices, or shops, in localities where the ordinary city gas is not to be had or is supplied at an excessive price.

Up to the present, the development in generator design and construction has rather tended toward multiplicity, rendered possible by the simplicity with which the gas can be generated, and inventors find that it requires very little ingenuity to devise a satisfactory apparatus for the purpose.

This multiplicity of apparatus is instructive as a study, but when they are actually to be introduced into communities where their faulty action, especially in the hands of careless or ignorant persons, may cause loss of life or property, the idea at once suggests itself: How are we to know whether any generator of the host offered for sale is safe?

To this question there is but one answer—test it, have some one else test it, or inspect it at some place where the generator has been in use for a long time. There are other considerations to be reckoned upon than the simple possibility of the apparatus being able to supply gas. Among these may be mentioned the possibility of the gas igniting through the generation of excessive heat in a generator which contains some air, and consequent explosion of the apparatus, although this is liable to occur only in the drip or dip types. Gas may escape into the generator room and be accidentally ignited. The apparatus may be so made that emptying or charging it fills the apparatus with too much air—a fact which soon becomes evident when the careless or ignorant operator brings a flame near it. Deposits of lime, tar and water in the house pipes caused by lack of filters and condensers, too much heating or violent generation, or an overproduction of gas may burst the apparatus or blow out the seals and fill the neighborhood with an evil-smelling gas. Many other inconveniences may be noted, but these are sufficient to show how important it is to have the apparatus tested or a satisfactory assurance that this has been done by competent persons.

In this connection the tests made by W. W. Duffield under the direction of Prof. Lewes* and Boverton Redwood, a sub-committee appointed by the London Society of Arts to test the generators submitted for the Imperial Institute Exhibition (opened June 15, 1898), may be of interest. It was decided that no apparatus should be admitted until tested and shown to be safe. They first adopted the following classification of generators:

1. Those in which the gas is generated by water being allowed to drip or flow in a small stream onto the top of the carbide.
2. Those in which water rises round the carbide.
3. Those in which the carbide falls into the water.

Automatic.—Those having storage capacity less than the volume of gas generated from the carbide charge and a regulating device to stop contact of carbide and water.

Non-Automatic.—Those having a holder large enough to take all the gas given off by the maximum charge of carbide.

This classification differs somewhat from previous ones, and is interesting for that reason. They then laid down the conditions for the admission of apparatus to the exhibition, of which the following is the substance:

Automatic Generators.—1. Working pressures must not exceed that of 100 inches of water (3·6 pounds per square inch). 2. When charged, less air must be inclosed than one-fifth the capacity of the apparatus. 3. Shutting off gas must stop generation in a seasonable time, and a pipe must lead any accidental overproduction outside the building. 4. Gas generation should not cause excessive heating.

Non-Automatic Generators.—1. Working pressure must not exceed that of 100 inches of water. 2. Air spaces should be as small as possible and generation should not be accompanied by excessive heating. 3. If pipe between generator and holder becomes choked, a blow-off seal must be provided or water may be allowed to escape through the water supply pipe.

Mr. Duffield was given a set of rules to govern him in his tests, of which the following is an abstract:

1. No generator to be tested until a sectional drawing is submitted with the signed statement that the apparatus is in proper working condition.
2. Details to be noted before testing: *a*. Dimensions of generating chambers. *b*. Charge carbide. *c*. Cubic capacity of gas holder or storage chambers. *d*. Vapor condensers. The cubic capacity of generating chambers determines the air introduced when charging.
3. Details to be noted during working: *a*. Pressure in generating and storage chambers. *b*. Temperature in generating chamber; the latter is determined by rods of tin (melts 434° Fahr.), lead (melts 629° Fahr.), and zinc (melts 790° Fahr.), placed in the carbide, and examined after generation for fusion. *c*. Weight carbide charged, and time until necessary to recharge in regular working. *d*. After removing residue, throw it into pail of water, noting whether gas is given off. Although all generators used the same grade of carbide, the yield in gas per pound varied from 3·55 to 5 cubic feet; this undecomposed carbide in the residue may cause annoyance and be dangerous. *e*. If the gas does not leave the generator cool, a Liebig's condenser may be used to cool the gas before testing.

The generator building was open at all sides, and each apparatus was connected to its own burners inside the exhibition building, forming a separate plant. A meter and mercury pressure governor was attached to each machine, and drip cocks provided for pipe condensation.

Every day a weighed quantity of carbide was supplied to each exhibitor and a printed record blank filled out. This blank contained the items: Name of apparatus, date, charge carbide, gas generated (by meter), equivalent in cubic feet per pound, number of burners supplied and hours lighted, kind of burner, pressure in generator and in supply pipe, cubic feet of gas used per burner hour, volume liquid removed from drips, condition of lime residue, water flowing to waste during run, and notes as to the general behavior of the apparatus.

"The generators which combine the largest yield of gas with strength of material and simplicity in charging the carbide, and in emptying the residue, are those which will recommend themselves to the public."

When manufacturers are trying to make good exaggerated claims for their apparatus, as to the number of lights it can supply, they are liable to overheat the gas and be pursued by a consequent long train of evils. The committee found that many of the machines submitted had to have their rating cut down before they would work satisfactorily. The temperature in these cases sometimes was sufficient to melt tin. They think that portable lamps may be dangerous, and should be handled with care. They are led to believe from their tests that generators can be made which are absolutely safe with ordinary precautions, as much so as any other method of lighting.

The concluding paragraphs of this report are worth giving in extenso, as they are authoritative. The committee includes such men as Professors Dewar, Lewes, Roberts-Austen, and Thomson, Sir Henry Wood, and others, all men of world-wide reputation, and it is worth while knowing what they think of generator types. They say:

"We consider that non-automatic generators, with a holder capable of taking the gas generated from the largest charge of carbide the generator will hold, are free from objections attending all automatic generators examined by us, and we are of opinion that every generator should be fitted with an arrangement by which all air can be rinsed out of the generating chamber by acetylene or some inert gas before action is allowed to commence between the water and carbide.

"We are also strongly of opinion that every generator should be fitted with a purifying chamber or chambers in which the acetylene is purified from ammonia and sulphureted and phosphureted hydrogen and from other impurities."

A point not touched upon as yet is insufficient construction. Some cheap generators are built of thin galvanized iron riveted and soldered and dignified by the name of gas machine. These generators soon become dented, and rust through in a comparatively short time; in some cases the temperature of generation becomes so great with the dip or drip type that the solder begins to melt, and it is not long before the apparatus leaks and must be thrown out. If generator manufacturers were more careful and insurance companies or city officials more vigilant in inspection, these and other evils would not be possible. In many cases the generator maker and his representatives are the worst enemies of acetylene lighting.

As the multiplicity of apparatus increases, the public good demands that some guarantee of safety be provided and that each type be tested thoroughly before it is put upon the market.

FOR many years it has been a much disputed point whether Molière died at No. 34 or No. 40 Rue de Richelieu, Paris, and whether 34 or 40 should bear the bronze tablet. Both houses had their partisans, which caused many quarrels. At last it has been decided it was in No. 40 that the great writer of comedies died.

* An interesting series of lectures delivered by Prof. Lewes before the Society of Arts was published in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1203, 1204, 1206, and 1209.

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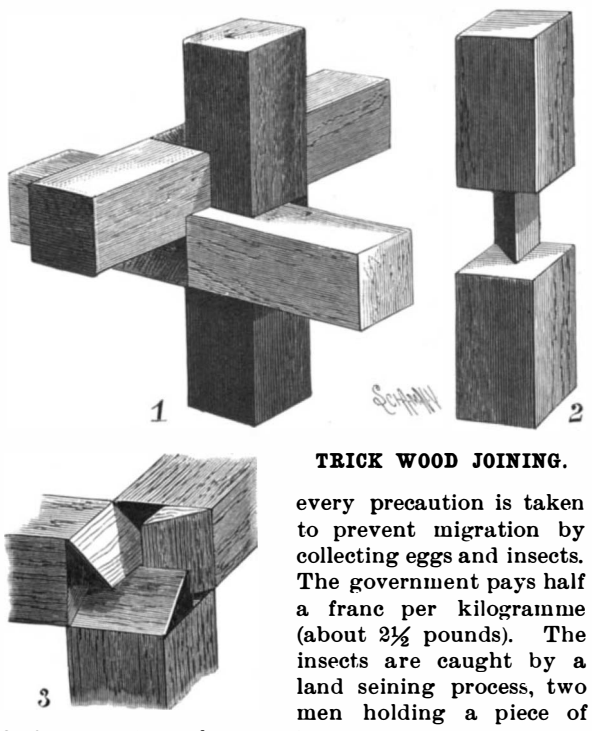
TRICK WOOD JOINING.

In the Scientific American for April 25, 1896, we published an article on trick wood joining, a study of which led one of our correspondents, Mr. Wilhelm Segerblom, of Wakefield, Mass., to design the curious puzzle which is illustrated in the accompanying illustrations, Figs. 1, 2, and 3. The problem is to join three pieces of wood, each at right angles to the other two, and so made that, when joined, they show no signs of cutting. They must be capable of being slipped together or taken apart with ease.

The puzzle, as herewith illustrated, consists of three short lengths of wood, each one inch square in section and five inches in length. At the center of each stick seven-eighths of the wood is cut away for a length of one inch, leaving the remaining one-eighth in the form of a triangular prismatic section of the shape shown in Figs. 1 and 2. One side of this prism is flush with the side of the stick, another side lies in a plane bisecting the stick diagonally and lying in its longitudinal axis, while the third side of the prism lies in a plane also passing through the longitudinal axis and bisecting the stick normally to its side. As each of the sticks is cut away in the same manner, they are in every respect identical.

The puzzle is to fit the pieces together so that each shall be at right angles to the other two and their axes shall intersect at a common point, and shall lie in two planes which are at right angles to each other. When this has been done, the center prisms will lie in the position shown in Fig. 3, where one-half of each stick is shown cut away in order to show the method of interlocking. In Fig. 1 the pieces are shown in the act of sliding into position. It will help the reader to work the puzzle successfully if he understands that the pieces slide into engagement with a diagonal and simultaneous movement; that is to say, it is impossible to lock two pieces and then interlock them with the third. The movement of the pieces is indicated by the arrows in cut 1.



TRICK WOOD JOINING.

INSECT MIGRATIONS.

BY PROF. C. F. HOLDER.

In the early spring, when insects seem to come to life, the hot sunshine bringing them out, many interesting phenomena may be seen. In the San Gabriel Valley I have several times observed a migration of yellow butterflies (Colias) that was remarkable for its duration and the vast numbers that undoubtedly formed a part of the swarm. My point of observation was the town of Pasadena, and for three or four days I watched the continual stream of yellow butterflies fluttering on, all flying in the same direction to the northeast. In looking out of a window two or three or more were in sight continually and others as far as the eye could see.

By personal observation I found that over an area of 16 square miles they were as numerous, a column of millions all moving in the same direction. Wishing to determine the limits of the migratory horde, I wrote to the towns 60 or 70 miles north and south, and the reply was that the same conditions existed there; so that from San Bernardino to Santa Barbara this living stream, representing millions of insects, extended. Why they were moving can only be conjectured. The yellow butterfly is famous for its migrations, and they have been met with out at sea, covering decks and rigging of vessels. Darwin mentions a column of these forms that was at least 50 miles wide and which was many hours in crossing a South American river. In this instance they were all moving in a given direction, following the dictates of some singular instinct.

The migrations of locusts are most devastating in their results. The accompanying photograph shows a doorway in Colorado Springs during such a passage. The numbers of this horde were incalculable, and the insects were swept out of houses like snow. There is hardly a Western or, for that matter, an Eastern State that has not suffered from time to time by these pests. In Colorado they so covered a railroad track that the wheels of the engine refused to catch and the train was brought to a standstill. It appeared to be caught in a dense fog, and the cab became so filled with the crawling, nauseating horde that the engineer retreated to the cars to wait until it had passed.

There is something especially disagreeable in these migrations, and history tells us that they have often occasioned great loss of life. The Bible records that John the Baptist fed upon locusts; and the practice is still followed by the Arabs in Arabia, Egypt, and Syria. The insects are ground in hand mills, the flour or meal being stewed in butter. In the south of France every precaution is taken to prevent migration by collecting eggs and insects. The government pays half a franc per kilogramme (about 2½ pounds). The insects are caught by a land seining process, two men holding a piece of cloth 30 by 40 feet long, and dragging it along the surface, scooping them in.

Some of the most remarkable migrations have been observed in Africa. Mr. Barrow, the noted traveler, saw the ground covered with migratory locusts for 2,000 square miles. The insects during the flight were blown into the sea by a northwest wind and were beaten upon the beach, forming a bank 4 feet in height for 50 miles. When the wind changed, the odor became intolerable for miles, and could be noticed 150 miles from the sea, the air, in the language of the observer, having become poisoned by the fetid exhalations.

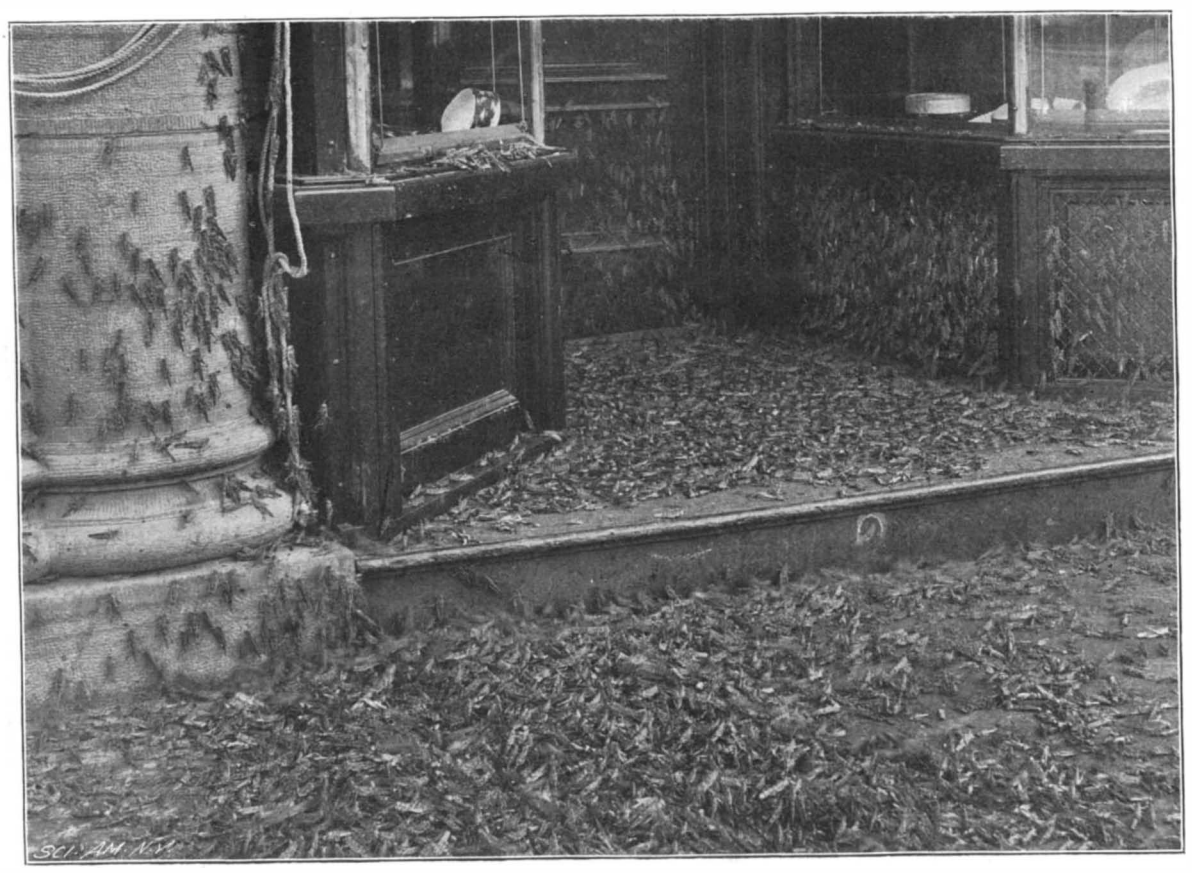
The South American countries are frequently devastated by these insects. Several years ago a migration passed the village of Luxan, near the river of that name. At a distance it had the appearance of a reddish cloud that was supposed to be the smoke of a terrible fire from the pampas country. Finally it reached the town, and was found to be a cloud of migrating locusts. They moved at a rate of about 15 miles an hour, and, when they alighted, changed the green of the surface to brown.

In Russia the migrations of locusts are considered national calamities, and were not the accounts of them well substantiated, they might well be doubted. In 1825 the government literally declared war against an invading horde of these locusts, and placed thirty thousand men in the field to oppose an army of locusts that was devastating the land. The call for help came from the inhabitants of Odessa and Kiev. This vast region was fairly enveloped in the clouds of locusts that covered the ground and high in air formed a black cloud of ominous appearance. The sun was darkened, the air filled with noxious odors. The migrating horde crawled into the houses and even the beds of the people, and changed what had been a fertile region into a desert. Every green thing, every leaf or twig that showed any evidence of life, was destroyed, and thousands of men, women, and children were faced with starvation.

The Russian farmers at first fought them by fire, whole towns and villages combining; but, while millions of the insects were consumed, it made no appreciable impression upon them. In some places the locusts would settle upon green spots to a depth of four feet, and when in the air and borne along by a heavy wind, the sound was appalling. The appeal was finally made to Moscow, and the emperor ordered out thirty thousand men, armed with shovels, bags, and fire. They formed a line of battle two miles in length and moved ahead, covering the locusts, raking them into piles and burning them. The men found the insects so firmly intrenched that it was impossible to make any impression upon them. The army wagons became blocked in the living mass and the horses were unable to move them, the insects crawling over the men and animals, which, finally maddened with fear, struggled and rolled in the seething, horrible mass. An official report stated that through the governments of Ekaternberg and Kherson, for hundreds of miles to the Black Sea, the locusts lay in a solid mass two feet thick. A naturalist traveling through the country in the interests of the government met the migrating horde fifty miles from Kiev, and they almost stopped his carriage, reducing the rate of speed from eight miles an hour to one.

On the island of Phanagoria the insects left the ground, and from a distance of five miles they resembled the smoke of an enormous volcano, hanging in the air at a height of six hundred feet. Thousands of people are said to have starved to death from this cause alone. In Algeria the French forces were once ordered out to make common warfare against the enemy.

Migrating locusts have long been a scourge in this country. Kansas and Nebraska and Colorado have been particularly unfortunate. In Nebraska during a certain raid, the sun was not visible for three days—a remarkable example of the numbers of insects constituting a migration.



A PEST OF LOCUSTS AT COLORADO SPRINGS.

Ice Bubbles Explode.

A traveler in Siberia tells of a remarkable occurrence among the frozen regions of that country. In the intensely cold nights, he writes in Good Words, the silence was sometimes broken by a loud report as of a cannon. This was the bursting of one of the ice bubbles on a river—a phenomenon I had neither heard nor read of before.

The streams coming down from the hills were frozen on the surface some 6 to 9 inches thick. The water beneath flowed faster than it could escape, and the pressure, on the principle of a hydraulic press, became irresistible. First, the elasticity of the ice was seen by the rising of circular mounds some 6 to 8 feet high. The bursting point came at last with a report like an explosion. The water escaped, but soon froze again. I have seen scores of these ice hillocks in a few versts of the river.

A Gold Medal for Prof. Dewar.

A gold medal has been conferred on Prof. James Dewar, F.R.S., of London, by the Smithsonian Institution, in recognition of his discovery of processes by which air may be liquefied; it is what is known as the Hodgkins medal. Mr. Hodgkins left $200,000 to the Smithsonian Institution, half of which was to be spent in aiding and rewarding the discoverers of new elements or properties of the air. The first call upon the fund was made some two years ago, when $10,000 was divided between the principal discoverers of the new element "argon," and four silver and eight bronze medals were conferred upon those whose efforts aided in the discovery. The gold medal given to Prof. Dewar is three inches in diameter and was made in the mint at Paris.

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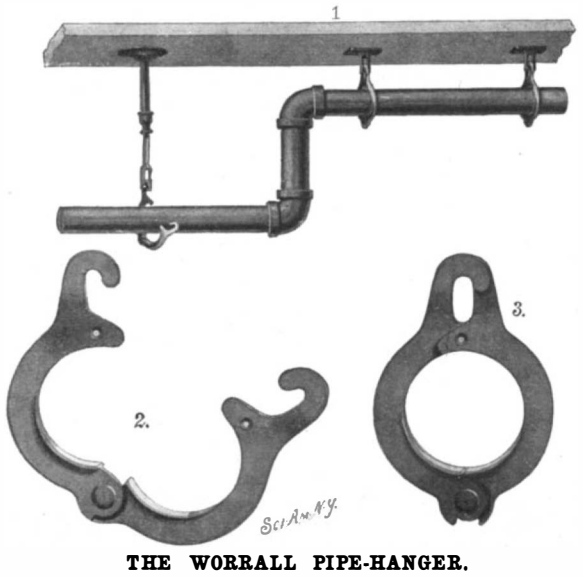
A SIMPLE PIPE-HANGER.

A most effective pipe-hanger is now being made by the American Twist Drill Company, of Laconia, N. H., the construction of which is noteworthy for the novel means employed to obtain greater strength.

The hanger is composed of two sections hinged together at one end. Each section is formed with a semicircular pipe-receiving portion with a projection constituting part of the semicircular portion, and with a hook-shaped end by which the device can be suspended. In operation, when the two hanger-sections are brought together, the semicircular portion will form a circular opening to embrace the pipe and



THE WORRALL PIPE-HANGER.

the hook-shaped ends will form an opening to receive the suspending means.

In order to prevent the separation of the hanger-sections the projections are provided with registering holes, which are adapted to receive a locking-pin. In order that the hanger-sections may brace each other and thus strengthen the device, they are oppositely bent, so that when brought together the hook-ends and projections will interlock. The locking-means employed will effectively prevent the accidental unfastening of the hanger-sections after having been applied to a pipe.

THE MULTIPHONE.

We publish herewith the latest development in talking machines, the multiphone, conceived and recently constructed by Mr. E. Berliner, the well known inventor of the loose contact transmitter, the gramophone, and other inventions. It is a gramophone in which a number of records, copies of one original, are played simultaneously.

Gramophone records are pressed from dies or matrices, like seals, under heat and pressure, and consequently all records of one catalogue number are exactly alike in every detail.

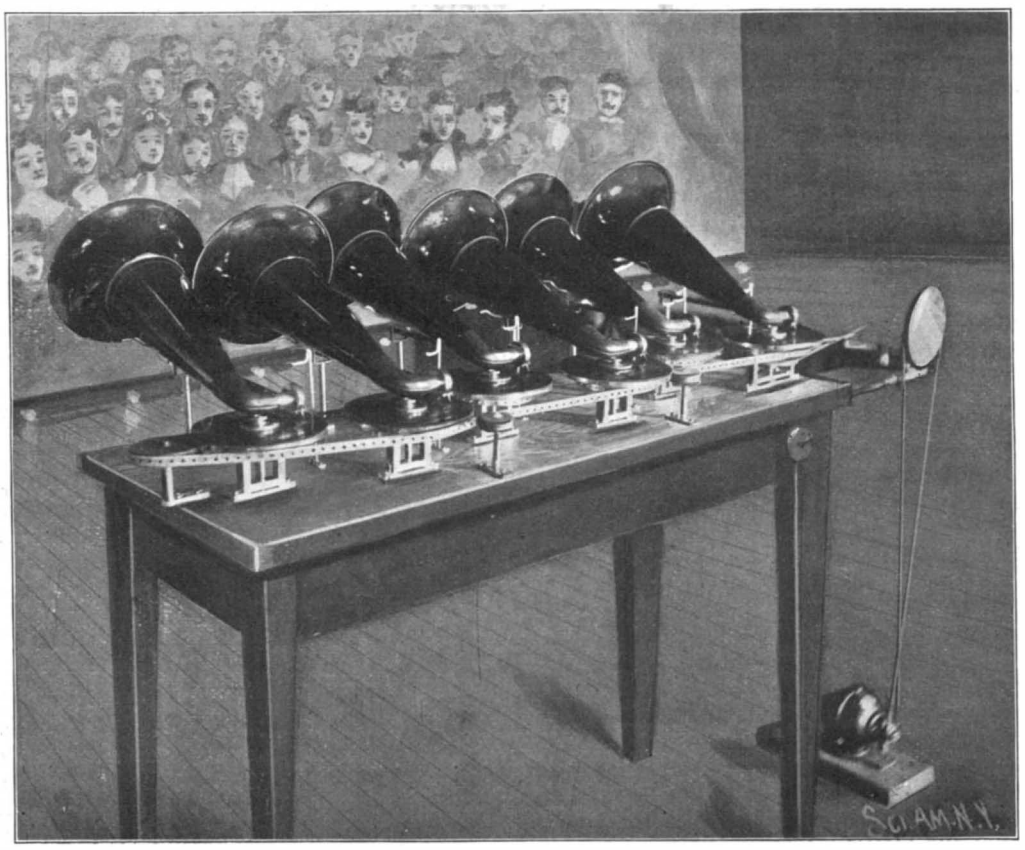
It has long been the aim of talking machine people to increase the loudness of their records without changing their quality, and, while others have worked in the line of special diaphragms, larger size of record waves, and enlarging by photography or leverage, Mr. Berliner has vastly increased the loudness of the talking machine by the simple device of rotating a number of records from one motor and playing them together. They sound like only one record, and with a loudness proportionate to their number.

The illustration shows a sextuplex multiphone consisting of six turntables run by one motor. Each has a sprocket wheel underneath, and a perforated leather belt rotates them with precision and without noise. Six records of the same catalogue number are placed on the turntables, so that the needles of the reproducing sound boxes all strike the records on the same peripheral line, which is most easily accomplished. The needle points are then slid from the edge into the first record line—an operation requiring no special skill.

After being placed in position, the switch is turned and the reproduction follows without a hitch.

It has long been known that the carrying power of the ordinary gramophone is most astonishing. It fills a hall the size of the Metropolitan Opera House, in New York, and on the water, on a quiet evening, it has been heard over two miles. Multiply these effects by six, and you have the performance of a sextuplex gramophone.

Any mechanic can also see that there is no difficulty in constructing a multiphone with sixteen or sixty records. The reproduction, particularly of talking records, is striking, and the possibility of producing a giant human voice is now within easy and safe reach. The experimental machine is at present in the hands of the Berliner Gramophone Company, of Philadelphia.



THE BERLINER MULTIPHONE.

New Composition for Matches.

Messrs. Sevene & Cohen, engineers of the French state manufactories, have recently succeeded in producing matches with a phosphoric combination that is less deleterious than the one that has hitherto been employed. The period of trial terminated some time ago, and for a few months past all of the manufactories of France have been using nothing but the new composition.

The substance recommended by Messrs. Sevene & Cohen is sesquisulphide of phosphorus, which has all the advantages of white phosphorus without the drawbacks of the latter. It is obtained through the combination of amorphous phosphorus and sulphur. It cannot be obtained in starting with white phosphorus, and so it can contain as impurities only red phosphorus and water. It melts at 142° and emits no vapors at ordinary temperatures; and neither odor nor smoke is observed in the works where the product is used. The toxicity of the substance is quite feeble. Messrs. Sevene & Cohen gave repeated doses of 3 centigrammes per day to guinea pigs without the latter appearing to suffer therefrom. This corresponds for an adult of medium size to 3·5 grammes, that is to say, to the weight of sesquisulphide contained in 6,000 matches.

In order to give the matches the necessary degree of inflammability, a certain proportion of chlorate of potash must always be added to the paste. The following is the composition of the paste at present employed and which permits of the manufacture of a new type of paraffined wooden matches that will ignite upon any surface whatever upon which they are struck:

	Parts.
Sesquisulphide of phosphorus	6
Chlorate of potash	24
Zinc white	6
Red ocher	6
Powdered glass	6
Glue	18
Water	34

The composition varies slightly according as the paste is designed for sulphur, paraffined, or wax matches. Not only is this product free from the inconveniences of white phosphorus, but the process of manufacture remains sensibly the same.

The Proposed Execution Prison.

Plans for the proposed State prison for executions for New York State have already been drawn. They provide for a stone fireproof building to be situated inside the walls of the Clinton prison, entirely separate and distinct from it, but near enough to obtain electric light and power from the plant of that prison. The structure will be divided into two sections, the administration department and the prison proper, which consists of cells and the electrocution chamber.

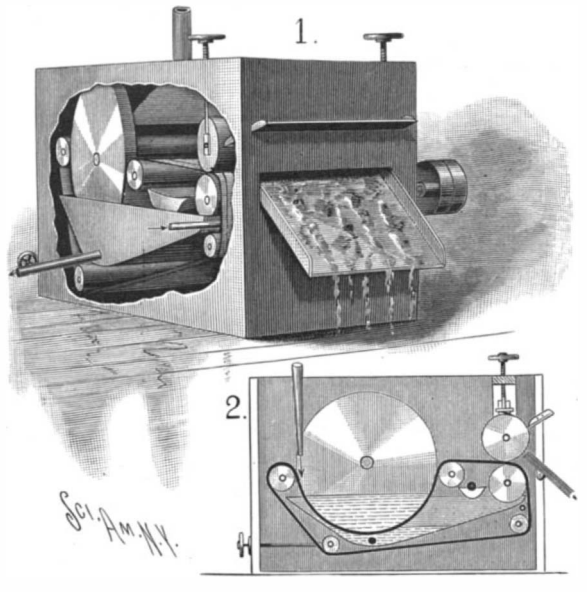
There is only one entrance to the building, which is through the office, from the rear door of which the guard is able to obtain a view of every cell in the prison. The cells will be located in the long structure one story high. They will be constructed of steel, with running water and all modern appliances. They will be twenty in number and will be situated in two rows in the cell department. They will have no windows, but will open on the central corridor. The corridor will also run around them. The cell department will be 92 feet long and 40 feet high, and the cells will be 8 feet square.

A MACHINE FOR FILTERING LIQUIDS.

In order to remove the foreign matter from dense liquids, such as oils, in a more rapid manner than has hitherto been possible, Mickael B. Koerper and Edgar C. Talley, of Waco, Tex., have devised a filtering machine in which an endless belt of filtering material is employed, coacting with a series of rollers.

Fig. 1 is a perspective view of the machine, parts being broken away to show the construction. Fig. 2 is a longitudinal vertical section through the machine.

The filtering machine is inclosed in a casing, in the sides of which the rollers are journaled. These rollers support the endless belt of filtering material. The belt is driven through a tank in the bottom of the casing by means of a driving-roller, above which there



A MACHINE FOR FILTERING LIQUIDS.

is adjustably mounted, as shown in Fig. 2, a discharge roller which receives the refuse matter. Partially submerged in the liquid contained within the tank are two large filtering disks, which are mounted on a shaft journaled in the casing, and which engage the belt.

The oil to be filtered is poured in a broad stream upon the belt between the disks by a spout having a flaring delivery end. By reinforcing the edges of the belt with a double thickness of material, a tight and liquid-proof connection is produced between the belt and the disks; for it is here that the greater portion of the filtering is accomplished. The oil, after having been cleansed, passes into the tank. The refuse matter is carried by the belt between the driving and discharge rollers, is compressed upon the discharge-roller, and is removed therefrom by a knife and discharged from the machine by means of a chute. The oil which has been filtered will be drawn from the tank by means of a pipe.

Since in the filtering of oils froth is produced, the inventors have mounted between the driving roller and one of the supporting rollers a small receiving trough. An outlet in the side of the casing permits the discharge of the froth collected by the trough. Beneath the driving roll a steam or air pipe has been introduced for the purpose of cleaning the filtering material when the oil is very heavy.

After the parts of the machine have been once adjusted, the inventors state that the filtering can proceed uninterruptedly.

THE officers and sailors of the "Yale" have received their share of the prize money accruing from the sale of the Spanish boat "Rita." After this vessel had been captured by the "Yale" it was purchased by the government for $125,000. The prize money to be divided amounted to $59,000. Captain Wise, of the "Yale," received $8,091; the smallest sum received by a seaman was $76.

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The Heavens in April.

BY GARRETT P. SERVISS.

April is a good month in which to begin the use of the opera glass among the stars. The increasing mildness of the nights, and the beauty of the constellations in sight, attract people out of doors and fix their attention on the sky. Overhead two striking star groups are visible—the "Sickle" of Leo, south of the zenith, and the "Great Dipper," in Ursa Major, north of it. That is their position at 10 P. M. at the beginning of the month, and at 8 P. M. at the end of it. At the same time Sirius will be seen near the horizon in the southwest, with Orion settling in the west and Capella, very bright and as white as a diamond, well up in the northwest. In the south is Hydra, with but one conspicuous star, situated in a barren region of the sky. West of Leo gleams the "Beehive," a cluster of minute stars in Cancer, which becomes interesting when viewed with a strong opera glass. Over in the east are Spica, glittering white, Arcturus, reddish yellow and looming large, and farther north the half-circlet of the Northern Crown.

THE PLANETS.

Mercury is an evening star, visible after sunset for a few days at the beginning of the month. On the 12th Mercury is in conjunction with the sun, after which it becomes a morning star. It remains in Pisces throughout the month.

Venus is also a morning star, gradually approaching the sun. She moves from Aquarius to the border of Pisces and Cetus, steadily losing brilliance.

Mars, which, in the course of the month, passes from Gemini into Cancer near the "Beehive," has faded since mid winter to the brightness of an average first magnitude star. It is still receding from the earth, and early this month attains its greatest distance from the sun.

Jupiter, near the border between Virgo and Libra, is very bright, rising between eight and nine o'clock and getting into good position for observation about midnight. On the 25th Jupiter will be in opposition to the sun, and consequently in an admirable position for telescopic study. It is an interesting experiment to look for the satellites of Jupiter with a field glass. One or more of them are certain to be visible, almost any clear night. The belts of the planet are now exceedingly beautiful when viewed with a glass of four or five inches aperture.

Saturn, which does not rise until about midnight, being situated in Ophiuchus, carries off the honors this month on account of Prof. Pickering's recent discovery that the great ringed planet has a ninth moon. The discovery was made by photography at the Arequipa observatory, and is very remarkable on account of the faintness of the new moon and its immense distance from the planet. The outermost moon of Saturn heretofore known, Japetus, is about 2,225,000 miles from Saturn, but the new moon, Prof. Pickering announces, is three and a half times as far from its primary as Japetus is. That makes its distance 7,875,000 miles, or more than thirty times the distance of our moon from the earth. Its stellar magnitude is given at 15·5; so that only a few of the most powerful telescopes in existence can be expected to show it. Its period of revolution is about seventeen months. Contrast this with the period of Saturn's nearest moon, Mimas, which goes round in only 22 hours and 37 minutes, and the extraordinary extent and variety of the system of which Saturn is the center becomes apparent. The period of the largest moon, Titan, is 15 days, 22 hours, and 41 minutes, while that of Japetus is 79 days, 7 hours, and 54 minutes. The discovery is another vindication not only of the value of photography in astronomy, but also of the independent manner in which Prof. Pickering has applied this powerful means of research.

Uranus is in Ophiuchus about 5° north of the red star of Scorpio, Antares. It rises one hour ahead of Saturn.

Neptune is rather more than a degree northwest of the star Zeta in Taurus.

THE MOON.

New moon occurs on the morning of the 10th, first quarter on the afternoon of the 17th, full moon on the afternoon of the 25th, and last quarter on the morning of the 3d. The moon is nearest the earth on the 6th and farthest from the earth on the 18th.

The lunar conjunctions with the planets occur on these dates: Saturn 1st, Venus 7th, Mercury 10th, Neptune 14th, Mars 18th, Jupiter 25th, Uranus 27th, Saturn 28th.

The Metric System in Our Colonies.

The advocates of the metric system in the House of Commons are greatly interested, according to a cable dispatch to The Sun, to know what decision the United States will arrive at regarding the system of weights and measures to be used in Cuba, Porto Rico, and the Philippines. They hope that the American government will not compel the abandonment of the metric system for the cumbrous English system.

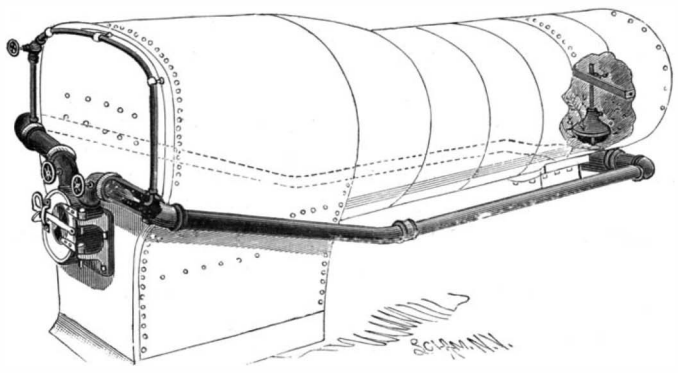
Vegetable Monstrosities.

Considerable attention has been given by botanists to the subject of vegetable monstrosities. These abnormal growths are not well understood, but it seems to be well established that many of them are the result of disease. It has been believed that not a few of them may be reproduced from seeds grown on abnormal plants. M. Hugo de Vries has been cultivating these strange anomalies for twelve years past and the results of his studies have been published in the Comptes Rendus. He says, with the exception of the plants which have been turned abnormally green by parasites, every plant developing unnatural growth with which he experimented was reproduced from its seed. He has, therefore, proved the heredity of the monstrous types. He isolated all the plants he raised, and a large proportion of their descendants were of the normal type, but the abnormal individuals were sufficiently numerous to prove the theory of heredity as well as disease as the cause for the multiplication of monstrosities.

AN IMPROVEMENT IN SMOKE-CONSUMERS.

There has recently been patented by James W. Alexander, of Bridgeport, Ohio, an ingenious device which is designed to draw the smoke, sparks, and cinders from the smoke-box of a boiler into the fire-box, in order that they may be consumed with the burning fuel.

The accompanying engraving shows the invention applied to a locomotive-boiler. At its forward end the boiler is provided with the usual smoke-box into which open the smoke flues extending from the fire-box. In the bottom of the smoke-box an opening is formed leading to a casing, from the sides of which suction pipes extend, running alongside the boiler to the fire-box. Near their rear ends the suction-pipes are fitted with valves. To each suction-pipe is connected a steam pipe, in order that steam may be forced through the suction-pipe to create a suction therein, in order to draw the smoke and cinders from the smoke-box into the fire-box. An adjustable bell-shaped deflector is



ALEXANDER'S IMPROVEMENT IN SMOKE-CONSUMERS.

located in the smoke-box above the opening and serves to distribute the sparks, cinders, and smoke uniformly.

When the suction-pipe valves are opened, and steam under pressure is allowed to pass through the suction-pipes, the smoke, gases, and sparks will be drawn over the deflector, down into the casing below the smoke-box, and through the suction-pipes to the fire-box.

The smoke-consumer possesses the merits of being simple in construction and effective in operation. It can be applied not only to locomotive-boilers, but to other boilers as well.

Manufactories in Turkey.

Dr. Cabell Whitehead has been tendered and has accepted an important position in the service of the Turkish government, and he will shortly enter upon his new duties. He will be virtually Director-General of Industries. The present Turkish Prime Minister has recognized the wonderful technical and scientific progress of the American nation, and has labored to introduce into Turkey American methods, American products and machines, as well as American scientists and technologists. Just now several large establishments are to be built, and the general management of them will devolve upon Dr. Whitehead. Dr. Whitehead was born in 1863 and is a graduate of Lehigh and Columbia Universities.

An American Bridge for the Soudan.

An erecting gang from the Pencoyd Iron Works will leave Philadelphia in a few days en route for Africa, for the purpose of building a bridge across the Atbara River, in the Soudan, near Khartoum. The order was placed with the Pencoyd Iron Works by the British War Office, less than six weeks ago, and the seven parts of the bridge, with a total length of 1,100 feet, have already been shipped. The Pencoyd Company was given the preference over English bridge builders, because the latter said it would take seven months to complete the structure. The British War Office was anxious to have the bridge completed before the fall, in order to facilitate the operations of Gen. Kitchener against the Mahdi.

The Windsor Hotel Fire.

For a quarter of a century the Windsor Hotel, at Fifth Avenue and Forty-sixth and Forty-seventh Streets, New York city, has been one of the most famous hotels in America. It was built in 1871 and opened in 1873. The hotel had a frontage on Fifth Avenue of 200 feet and on Forty-sixth and Forty-seventh Streets of 160 feet. It was seven stories in height, was built of brick, and had no architectural pretensions. The Windsor Hotel, although intended to be fireproof when it was built, was really a most excellent fire trap. On each floor five broad corridors intersected, and in the middle of the building were two wide shafts, constructed for the purpose of admitting additional light and air. Broad staircases led from the office floor to the parlor floor, and other broad staircases connected with the succeeding floors. This scheme could hardly have been improved upon for hastening the destruction of the house by fire. It was built upon a plan really obsolete, at the time it was constructed. Many times the building authorities had insisted upon adequate fire escapes being built on the fronts of the building, but their efforts had been unavailing.

Never within the knowledge of the fire department of New York has the uniformed force acted with greater heroism, but their efforts were in many cases futile, owing to the bad construction of the building. Fifteen minutes after the alarm had been turned in, the roof of the big hotel had fallen, and the fire was spectacular to the last degree.

Iron fire escapes on a building, if they are well constructed and numerous, will, perhaps, save a great many lives, but it must be remembered that with flames pouring out of the windows below, often those who try to descend by such means find themselves cut off from escape before reaching the ground. The intense heat soon makes them red hot gridirons, and then they are worse than useless. The ordinary rope fire escape in its present form is almost useless, as few men and almost no women understand the art of descending fifty or sixty feet with the aid of a rope. The friction soon cuts into the flesh, and the user falls to almost sure death or severe injury.

It seems as though inventors could devise some practical form of fire escape which would answer in cases of this kind. A fire escape to be really practical must be simple and easily understood by the user, who has no time to read instructions or to do much adjusting of the apparatus in an emergency. The individual fire escape for hotels and buildings which are not fireproof or provided with a fireproof stairway really seems to be a partial solution of the difficulty. Of course it would have been very easy to have constructed an absolutely fireproof tower in this hotel, doors leading to the stairways from every floor, but would the guests have known where to go to reach this point of safety?

The fire has resulted in many suggestions as to the protection of hotels and similar buildings which are not fireproof. Asbestos curtains, sprinklers, alarms in every room, and other well-known schemes have been advocated. The real solution of the problem is to build hotels which shall be really fireproof, so that if a fire starts in one room, it can be confined to it.

There have been fires in several modern fireproof hotels and we believe that no serious injury other than the gutting of one or two rooms has resulted. Many hotels in New York city which conform to the building and fire regulations of the period when they were constructed are now very little better than was the Windsor Hotel. As they are substantially built, however, nothing can be done in the way of condemning them. Already the proprietors of New York hotels have had several meetings and have expressed a desire to co-operate with the authorities in framing building laws and fire regulations which would tend to increase the safety of their guests and prevent another horror like the Windsor Hotel fire.

Prizes for the Care of Cars.

In Birmingham, Ala., the street railway company decided to offer prizes to the men for the care of cars. Conductors on the electric cars and motormen of fare box cars who have kept the neatest cars will be given $10, while those whose cars have been habitually dirty will be discharged. All motormen who have not cost the company anything for damages will be given $20, while those who have not cost the company over $5 for collisions or breakdowns will get $5. All those who cost the company over $25 damage will be discharged, unless they can prove that the accidents were not caused by carelessness. Similar schemes might be applied to advantage on many of our Eastern lines.

According to the Bulletin de la Direction de l'Agriculture et du Commerce, published by the government of Tunis, the Bey, on December 3, 1898, decreed that, after the date mentioned, all irrigating machinery and the windmills used in driving the machinery shall enter the regency of Tunis duty free, provided that the two apparatus in question be imported at the same time.

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THE IMPROVED TURRETS OF THE BATTLESHIP "TEXAS."

BY ROBERT W. HENDERSON, UNITED STATES NAVY, U. S. S. "TEXAS."

The great naval battle of July 3, off Santiago, which ended in the complete destruction of Admiral Cervera's fleet, has shown in the most realistic manner possible that too great a value cannot be placed upon rapidity of fire and rapid-firing guns on board a man-of-war. The battleship "Texas" took a very important part in this battle, and the efficiency of her large guns is due chiefly to the improvements on her turrets, instigated by Lieut. F. J. Haeseler.

The "Texas" is a first rate battleship of the second class, having a displacement of 6,315 tons. She is 309 feet over all, has twin screws, triple expansion engines, and on her trial trip she had an indicated horse power of 8,610, giving a speed of 17·8 knots. Her main battery consists of two 12-inch breech-loading rifles mounted in turrets and six 6-inch B. L. Rs. which are slow fire. The turrets of the "Texas" and those of the "Maine" are on the same general plan, the port one on the "Texas" being forward, the starboard one on the "Maine," the turrets being situated in echelon. The "Texas" turrets and barbettes are of 12-inch face-hardened steel armor, while the ammunition hoists and tubes are protected by 8-inch armor. The turrets, ammunition hoists, and rammers are all worked by hydraulic power, the engines being of the three cylinder Brotherhood type. The power is furnished by four powerful hydraulic pumps, all the machinery being inside the armored redoubt.

When the "Texas" went into commission, it was impossible to load these 12-inch guns except in two positions, pointed directly ahead or directly abeam, the rammers for these two positions being outside the turrets. When firing in intermediate positions, it was necessary to train the gun off the target to load, picking the target up again after loading. This consumed much time, the interval between two shots from the same gun being at that time about seven minutes.

Lieut. Haeseler advanced the idea of carrying a light but strong telescopic rammer inside, which was to revolve with the turret, thus enabling the gun's crew to load from any position. To accomplish this it was necessary, besides securing a strong rammer that could be easily handled, to change the lead of many of the hydraulic pipes, secure a "change" or "balance pressure" valve, and to devise a means of loading inside the turret. A "balance pressure" valve that could be used as a supply, exhaust, and reversing valve was obtained by a slight modification of a "Sellers" valve, and the hydraulic plant was changed accordingly. Immediately behind the breech of the gun, when level, a strong but light telescopic rammer was balanced on trunnions, which permitted its being raised or lowered into working position by one man. The rammer is shown in our illustration to the rear of the breech of the gun.

The next problem was to devise a means of transporting the 12-inch shell, which weighs 850 pounds, from the ammunition hoist outside the turret to the breech of gun, as formerly they were hoisted into a loading position forward of the stationary rammers. A circular track carrying a small traveling car was placed entirely around the turret inside the redoubt and a grooved table was put just inside the turret opening. When a shell was sent up from the ammunition room below, it was whipped by a chain strap and differential pulley into the traveling car, run around to the turret opening by one man, and shoved into the stationary table.

Inside the turret another ammunition lift was placed, running by hydraulic power, and fixed so that in its upper position the shell table on it was level with the bore of the gun in its loading position. One man pushes the shell into the shell table; the powder, which is in four sections, is placed in stands beside the shell; the car is hoisted; the shell and powder are run home by the rammer, and the car lowered for another charge. A small loading platform, working on hinges and secured by a hook, was placed under the breech of the gun, to allow a man to wipe out the powder chamber after the gun has been fired. An interesting experiment was tried in regard to sighting the turret guns, which would have been very useful in case of accident to the regular sights. The gun is sighted by means of telescopic sights placed in hoods on each side of the breech, the officer in charge being in this hood and sighting the gun. Ordinarily, in case this hood were to be demolished by a shot, the gunners would be unable to obtain anything like an accurate aim.

Through an aperture in the turret, near the gun, a small tube was placed which was laid exactly parallel with the bore of the gun. Cross wires were fitted in the ends of this tube for sighting. Near the elevating slide, at the side of the gun, an arc was fixed firmly, graduated in yards, and a pointer attached to the slide pointed out the yards on this arc, the accuracy of the arc having been tested by the regular sights. To aim the gun by this improvised sight, the gun was trained on the target by means of the fixed tube, and the gun was elevated or lowered until the pointer on the slide showed on the arc the number of yards indicated on the range finder. The test shots with these sights gave very accurate results.

This constituted the repairs that were made on the guns in the New York navy yard, and after preliminary drills the "Texas" went out beyond Cape Henry, at Old Point, to test the work. The result was even more than expected. A mean between the intervals of five shots was one minute and fifty-five seconds, a vast improvement on the old record, while one interval was as low as eighty-five seconds. The "Texas" returned to Old Point ready for whatever was to come, and her record during the late trouble showed how completely she can be relied upon.

Formerly, for these 12-inch guns, there were but two kinds of shells, common and armor-piercing, as shrapnel are not used in the larger guns. Common shells are rather long, weigh 850 pounds, and carry a bursting charge of about 60 pounds of powder. Armor-piercing shells are the same weight, but are somewhat shorter, carrying no explosive charge. They are made of the hardest steel, with toughened point, intended, as the name indicates, to penetrate armor. The new armor-piercing shells have soft steel caps on the points, supposed to give them a greater penetrating effect. A new shell that has lately come into use, and which did good service during the late war, is known as a "semi" shell. It is a combination of the other two, of the same weight, has a hard steel head designed to penetrate light armor, and carries in addition a bursting charge of about 50 pounds. This shell is especially designed for use against armored cruisers or vessels of light protection, and is very effective. The igniting fuse for this shell is a base fuse, instead of the old nose fuse used in common shells. Common shells are intended to be used against forts, earthworks, and unprotected vessels, and were used almost entirely against the batteries before Santiago.

It could always be told when a shot struck, as a great cloud of dirt, smoke, and debris would rise in the air as a shot exploded. Several times, most notably during the engagement of the "Texas" and La Socopa battery, the guns of the Spaniards were completely buried by the earth thrown up by these shells, but the Spanish soldiers had discreetly retired to a pit on the opposite side of the hill, smoking in calm safety, to return, when the ships had retired, with mules and workmen, hauling out and remounting their guns.

While armor-piercing shells are meant to be used against protected vessels, the "semi" shells, carrying an explosive charge, were used principally during the battle, July 3. Of these shots there is a record of but two, both of which struck the "Infanta Maria Teresa" on the port quarter, entering just under the berth deck. A remarkable feature was that the holes made by these two shells were so close together that they lapped each other, giving a convincing proof that "lightning" does strike twice in the same place. These shots entered and exploded in the after torpedo handling room, and the effect, as seen by the writer, was something awful. Stanchions were cut to ribbons, frames wrenched from the side plating, and the deck beams were severely twisted. Everything in this part of the ship was wrecked, and a large jagged hole, about 4 feet square, was made in the starboard side. The effect of some of the 8-inch shots was nearly as great. The one exploding in the forward turret of the "Oquendo" alone wiped out the entire gun's crew, and put the gun out of commission.

That the large guns of the "Texas" did most efficient work is shown by the attitude of the Spanish officers, who not only feared the marksmanship of the "Texas," but were surprised to hear that she was not one of our best and most formidable ships. A bright tompion in the muzzle of the starboard 12-inch gun shows by the following inscription the service it has seen: "Santiago de Cuba," "Guantanamo," "Maria Teresa," "Viscaya," "Oquendo," "Cristobal Colon," "Pluton" and "Furor," "Reina Mercedes," "La Socopa."

The crew of the "Texas" showed their appreciation of his services by presenting Mr. Haeseler with a beautiful gold watch with the following inscription: "Presented to Lieut. F. J. Haeseler by the crew of the 'Texas,' in appreciation of his services in creating the 'Old Hoodoo' into the 'New Hero.'"

Considering the severe tests to which she has been subjected, it is safe to say that when her slow-fire 6-inch guns have been replaced by rapid-fire guns of the same caliber, there will be no more efficient vessel of her size in our entire navy than the battleship "Texas."

Special attention is invited to the front page engraving, which, in addition to showing the improved method of loading the guns, gives an excellent view of the interior construction of a modern battleship. The side plating of the ship is supposed to be cut away, giving a view of the interior from the main deck down to the handling room at the bottom of the ship. The shells are brought to the ammunition hoist in a sling, suspended from an overhead track. The cage has two platforms, the upper of which carries the powder, done up in sections, and the lower the shells. The cage is hoisted by hydraulic power, and the ammunition is transferred from it as already described. On the same deck with the magazines are the engines and boilers, one of the latter being shown in the engraving, and above them is a steel deck, 2 inches in thickness, which protects this portion of the vessel, known as the "vitals," from shell fire. Along the sides, at the water line, is shown the belt armor of 12-inch steel, and between the belt and the boiler rooms are the coal bunkers, which add their protection to that of the belt. A shell striking above the belt would have to pass through several feet of coal to reach the interior of the ship; if it struck on the belt, it would have to penetrate 12 inches of Harveyized steel and several inches of wood backing and many feet of coal before it could endanger boilers, engines, or magazines. The water itself effectually prevents the entrance of shell below the water line.

A New Gun Camera.

A new gun camera, probably the finest ever built, is being constructed in Chicago by William Gaertner for the Smithsonian Institution, at Washington. The specifications required that the instrument should be capable of making a successful exposure in one six-hundredth of a second. It is hoped that this speed will be increased so that a good negative may be obtained by an exposure of only a thousandth of a second. The principal purpose for which this camera was designed is to serve the photographing of aerodromes, with which Prof. S. P. Langley, secretary of the Smithsonian Institution, is conducting elaborate scientific experiments in an attempt at the solution of the problem of aerial flight. The instrument is provided with a delicate measuring apparatus, by which the precise angle at which the camera is tilted at the moment of exposure is known to the operator and is also photographed on the plate. This device will enable scientists to determine, under given conditions, the exact location and elevation of the object photographed.

Motor Carriage Contest at Liverpool.

A motor carriage competition will be begun at Liverpool on the morning of July 31, and the tests will conclude on the evening of August 2. Trial runs will be made from Liverpool, over a distance of from 30 to 40 miles. There will be four classes of vehicles eligible, the minimum loads being 2 tons, 3½ tons, 5 tons, and 6 tons, the long ton being reckoned. The vehicles must be propelled by mechanical power alone, but there will be no restrictions as to the source of power or the nature of the agents used. The hope has been officially expressed that vehicles from the United States will take part in the competition. Interested parties can secure details of conditions, regulations, etc., by addressing E. Shrapnell Smith, Honorary Secretary of the Self-Propelled Traffic Association, Royal Institution, Liverpool, England.

An Ocean Line Pigeon Service.

The Compagnie Generale Transatlantique, better known as the French line, proposes to develop its carrier pigeon service, following the experiments which were carried out on board the "Bretagne" a few months ago. The birds will be trained at Havre and New York. The vessels that go outward-bound from Havre will release pigeons after passing the Scilly Islands and when approaching New York. It is believed that in the last case the birds will give notice of their arrival some twelve hours before the vessel is observed at the Fire Island station. The service will begin during March, and it is assumed that when it is fully developed, communication between the land and the steamers of the company will be interrupted for less than five days.

A New Record at the Blue Hill Observatory.

The world's record for kite flying was broken at the Blue Hill Observatory, whose work we have so recently illustrated. On February 28 an elevation of 12,507 feet above the sea level was obtained by the highest of a string of tandem kites. This is 383 feet higher than the preceding best record, made at the same place on August 26. The flight was begun at 3:40 P. M. and the temperature at the surface was 40 degrees, and the wind was blowing at the rate of seventeen miles an hour. At the highest level the temperature was 12 degrees and the wind velocity fifty miles an hour. The combined kites had an area of 205 square feet and weighed 26 pounds, while the weight of the wire was 76 pounds. A series of five high flights were made on successive days, Sunday excepted. The average height reached was 10,300 feet, or nearly two miles.

A Large Timber Ocean Cradle.

An immense timber cradle has been under construction at Seattle, Washington, during the past three months, and the last section of the odd-looking craft was launched on March 20, and will be placed in position to receive the first cargo in a few days. It is thought that the cradle will have a capacity of 3,000,000 feet of lumber. Many lumber shippers are afraid the craft will never reach San Francisco, its destination.

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QUADRUPLE COMPOUND HARMONIC MOTION.

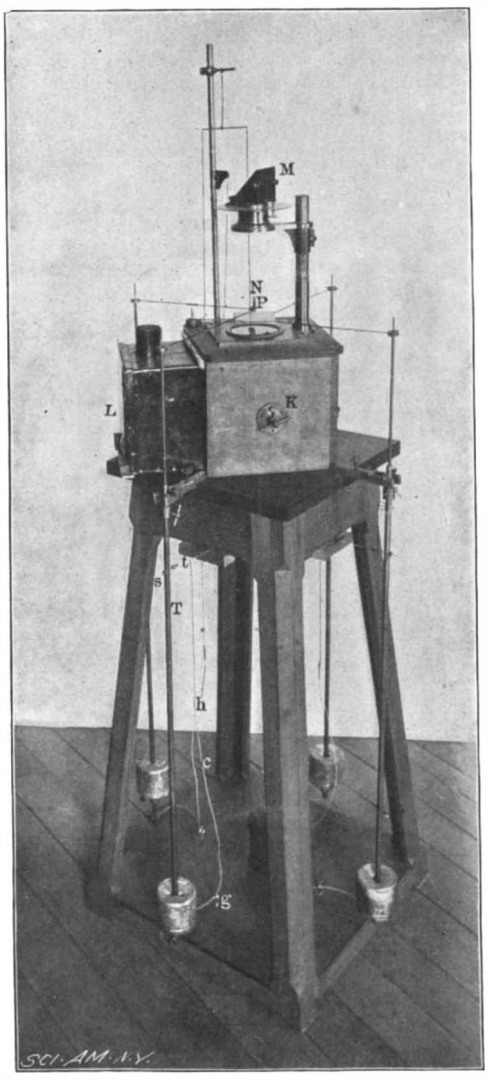
BY M. J. HOFERER, S.J.

As the science of physics advances, harmonic motion of some kind or other is found to be at the bottom of almost all phenomena. Some of the experiments, especially those in compound harmonic motion, are very interesting and instructive. The physicist's ordinary instrument for this purpose is the double pendulum, in which a needle is made to trace upon a glass plate the resultant of two pendulum motions in planes at right angles to one another. If the two pendulums are isochronous, the needle will trace straight lines, ellipses, or circles, according to the phase of oscillation. If the pendulums are not isochronous, but of lengths corresponding to the squares of the ratios 1 : 2, 2 : 3, 3 : 4, 3 : 5, etc., the needle will trace a series of curves similar to those represented in Figs. 1, 2 and 3.

If, however, the plate holder itself be suspended by a thread, so as to move without friction, and then be attached to two other pendulums, and all four be set in motion, each with its own time, phase, and amplitude of vibration, the result will be a new series of figures, more numerous and far more beautiful than the preceding. Then a calcium or electric light may be placed under the plate and the figures thrown upon a screen while in course of formation. The effect can easily be imagined—a perfectly dark field, receiving gradually bright, white light, in the shape of magnificent curves, circles, stars, and an almost unlimited number of other figures.

The photograph represents a quadruple harmonic motion pendulum designed by the writer and constructed under the direction of Rev. T. J. Freeman, S.J., professor of physics at Woodstock College, Woodstock, Md., and used with good effect in a public lecture on harmonic motion.

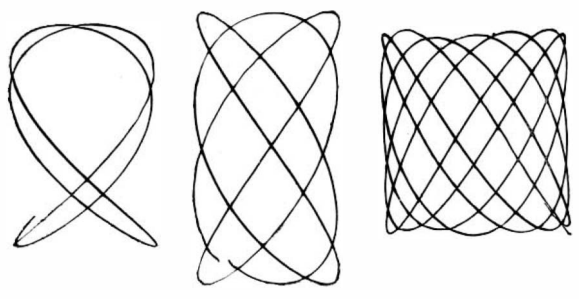
It consists of a solid table 40 inches in height; four leaden pendulum weights, of 12 pounds each, and capable of being raised or lowered at will; four ½ inch brass tubes resting upon knife edges and carrying gimbals at the top with steel wires, which are connected hinge fashion with the needle, *N*, and the plate holder, *P*. This plate holder is suspended from a standard 20 inches in height, and carries a darkened glass plate upon which the needle moves and traces its circuitous paths. An excellent plate darkener has been found to be a thin coat of vaseline covered with lampblack. These plates, if covered with another coat of varnish, serve the purpose of first-class negatives for photographing the curves. Then there is the ordinary apparatus for projection, *L*, being a metallic inclosure for the lamp, and the key, *K*, the axis of a mirror which reflects the light up through the plate, *P*, and into the prism, *M*, whence it is thrown upon a screen. And last, but not least, there is the contrivance for determining the phase and amplitude of vibration, two elements in these figures only second in importance to time itself. The amplitude depends upon the length of the cord, *c*, which, beginning at the key, K^1, and passing down through the tube, *T*, and then through the screw-eye, *g*, is fastened to a small hook, *h*, hanging from the block, *b*. This hook is raised (thereby pulling the pendulum toward the screw-eye, *g*) and put up through a hole in the block, *b*, at the top of which the hook is caught by the end of a little lever, *l* (Fig. 18). This lever is connected with the adjacent pendulum, *a* by means of the thread, *t*, whose exact length, adjusted by means of the thumb-screw, *s* (see photograph), determines the phase of oscillation.



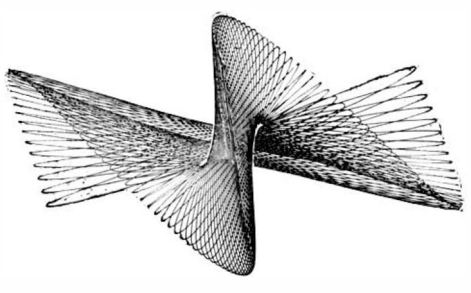
QUADRUPLE HARMONIC-MOTION PENDULUM.

Fig. 18 gives a view of all three levers and their connections, and Fig. 20 the same in a different position. It will be noted that pendulum, *a* (Fig. 18), is set off by hand, and then *a*, pulling the lever, *l*, sets off pendulum, *b*, then *b* performs a similar service for *c*, and *c* for *d*, and supposing each set of pendulums to be isochronous, both needle and plate will circle around in the same direction, that is, counter clockwise. In Fig. 20 the needle and plate take opposite directions, thereby producing an entirely different class of figures, each class containing an endless number of varieties, determined by modifications in time, phase, and amplitude. A few of the more striking figures are shown in the accompanying cuts.

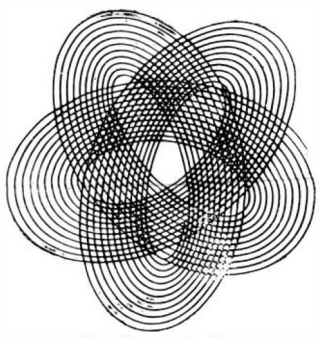
It may be asked here whether there is any way of



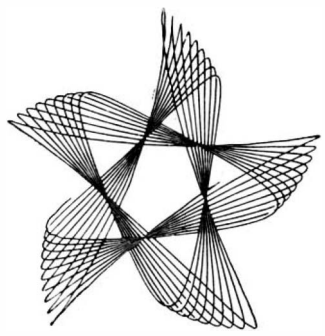
1.—Ratio 2 : 3. 2.—Ratio 3 : 4. 3.—Ratio 5 : 7.



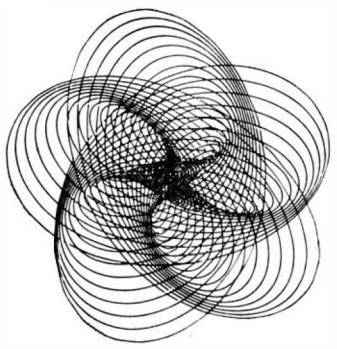
4.—Close ratio.



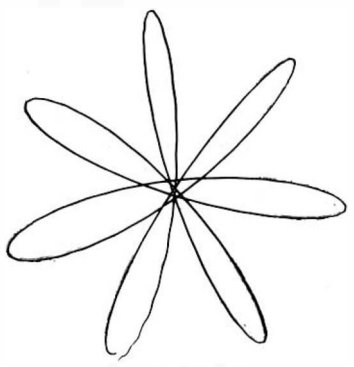
5.—Ratio 2 : 3.



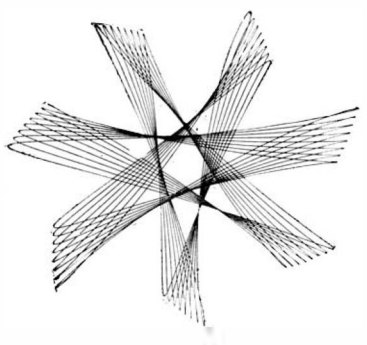
6.—Ratio 2 : 3.



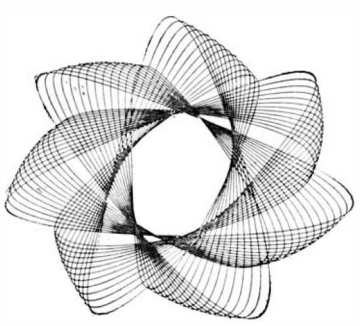
7.—Ratio 2 : 3.



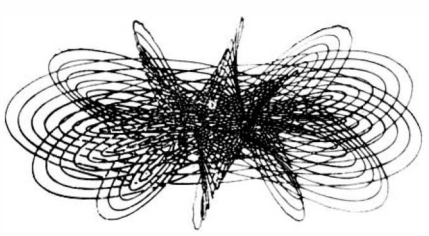
8.—Ratio 3 : 4.



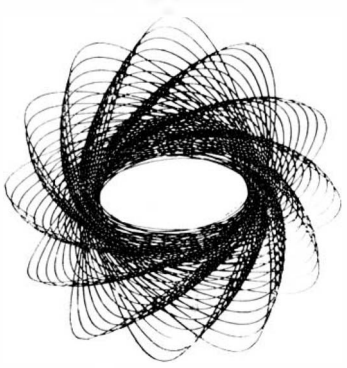
9.—Ratio 3 : 4.



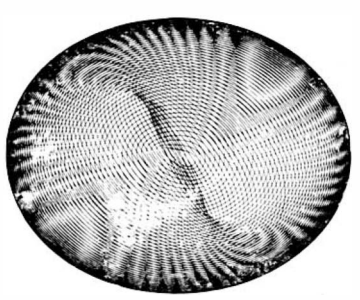
10.—Ratio 3 : 4.



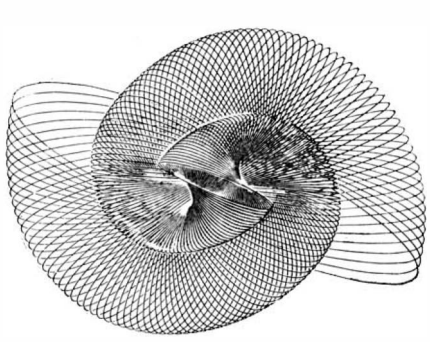
11.—Ratio 5 : 7.



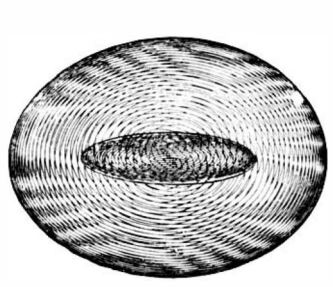
12.—Ratio 5 : 7.



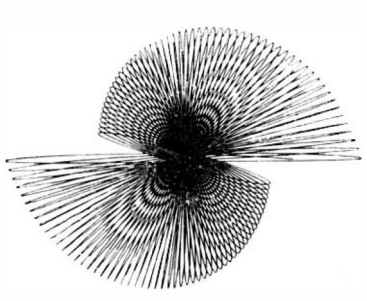
13.—Close ratio.



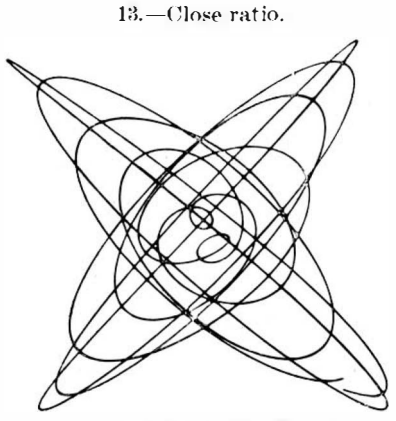
14.—Close ratio.



15.—Close ratio.



16.—Ratio 59 : 60.



17.—Ratio 9 : 11 : 13 : 15.

FIGURES PRODUCED BY THE QUADRUPLE HARMONIC-MOTION PENDULUM.

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telling by inspection the amplitude and oscillation ratio of the two circular motions required to produce any of these figures. The answer to these questions is much simpler than may at first be imagined. First, the ratio of oscillations may be known from the number of points or loops in the figure, since this number is always equivalent to the sum of the two numbers of the ratio, e. g., 2:3 = 5 points or loops (Figs. 2, 5, 6, 7), 3:4 = 7 (Figs. 2, 8, 9, 10), and 5:7 = 12 (Figs. 2, 11, 12). But how can a person tell whether, for example, the ratio was 5:6 = 11, or 4:7 = 11? By this simple rule: The lesser number of the ratio is invariably one greater than the number of points or loops cut off by any line

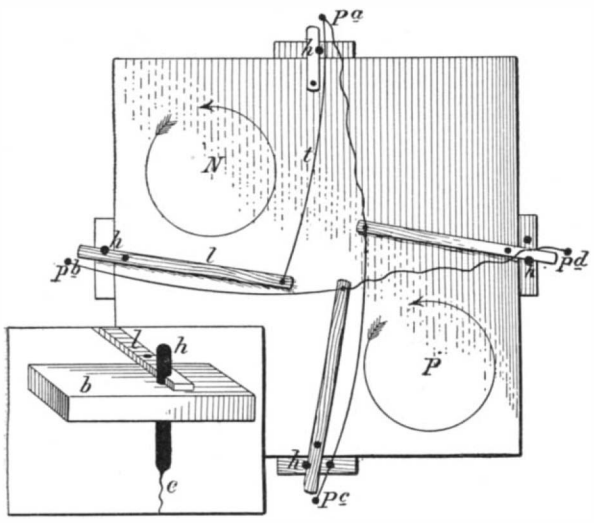


Fig. 18.—LET-OFF MECHANISM.

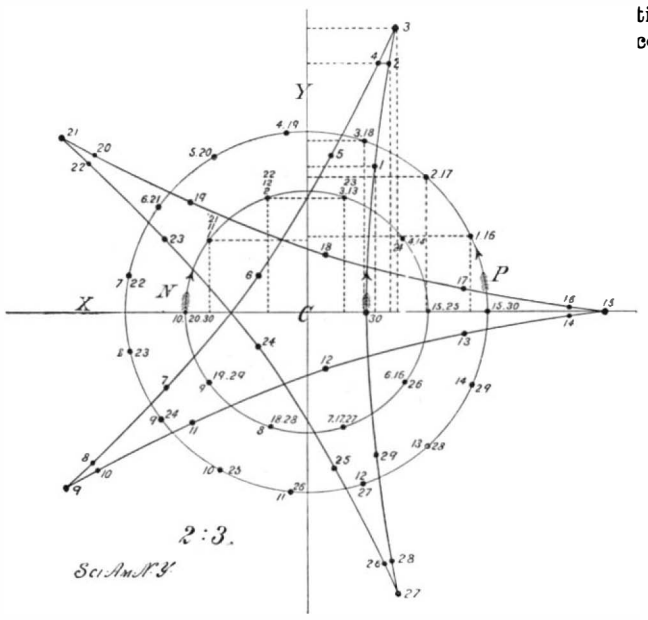


Fig. 19.—METHOD OF PLOTTING THE FIGURES.

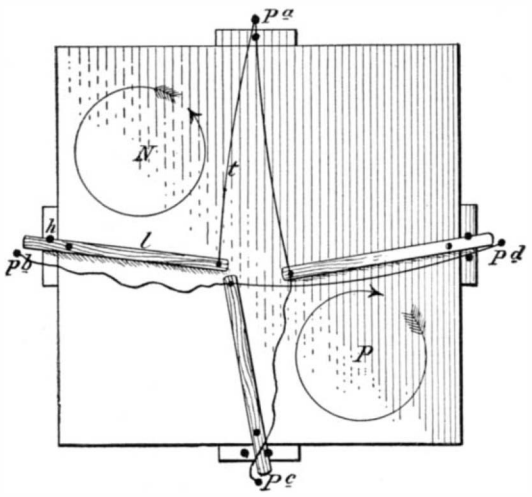


Fig. 20.—LET-OFF CAUSING NEEDLE AND PLATE TO MOVE IN OPPOSITE DIRECTIONS.

in the figure, as may easily be verified in Figs. 2, 6, 8, 9, 12. Secondly, the amplitude of the two circular motions may be found in the following manner: The distance from the center to the farthest part of the figure is the sum of the two required amplitudes, and the distance from the center to the nearest part of the figure is the difference of the two amplitudes, and from the sum and difference the two amplitudes themselves may easily be found. Figs. 5, 6, 7, of the ratio 2:3, and Figs. 8, 9, 10, of the ratio 3:4, show how figures of the same ratio may be varied by a simple change of amplitude. Figs. 2, 13, 14 and 15, 16, show how the resultants may be varied by starting the plate and needle in the same or opposite directions. Fig. 17 is a sample of what may be obtained by having all four pendulums of different lengths.

Fig. 19 shows how the resultant of quadruple harmonic motion may be plotted beforehand and then verified upon the pendulum. The diameters of the two circles represent amplitude of swing, and the divisions of the circumferences, distances traveled in equal times by the needle and the plate. Then the algebraic sum of the sines and cosines at each instant 1, 2, 3, etc., after starting will give the exact position of the resultant at the same instant, and a line passing through all these points will describe the figure which the combined motions of all four pendulums would, under the given conditions, produce.

It may be remarked in conclusion that the starshaped figures beautifully exemplify the action of plain polarized light in passing through quartz crystal, where, according to theory, the beam is broken up into two circularly polarized beams going in opposite directions and at different speeds, thereby shifting the original plane by an angle proportional in size to the thickness of the crystal.

THE LATE PROF. O. C. MARSH.

Prof. Othaniel Charles Marsh, who occupied the chair of paleontology and was curator of the geological collections of Yale University, died at his residence at New Haven on March 18, 1899, of pneumonia.

In the death of Prof. Marsh American science has suffered the severest blow since the death of Prof. Cope. He was born in Lockport, N. Y., in 1831; his maternal uncle being the eminent banker George Peabody. From early youth Prof. Marsh was addicted to athletic exercise, and he was a sportsman before he became a scientist. This out-of-door life and contact with nature soon turned his attention to the study of natural sciences, and at the same time it contributed robustness and vigor to his frame, which enabled him in after life to perform without weariness an amount of thorough and efficient work under which the bookish man would have succumbed. In 1852 he went to the Philips Exeter Academy at Andover, Mass., and graduated as valedictorian of his class. He entered Yale College in the fall of 1856, graduating in the class of 1860 with high honors. The next two years he studied in the scientific school of the college, devoting his attention to mineralogy and paleontology. His vacations were generally spent in Nova Scotia, in the study of the paleontology and geology of that then little known country, and it was there that his first great discovery was made, the two celebrated vertebræ of the Eosaurus acadianus, the earliest fossil example of reptilian life then known. In 1862 and 1865 he studied zoology, geology, and mineralogy in the principal German universities, among the most eminent teachers of the time, passing his vacations in field work in various parts of the Continent and specially in the Alps.

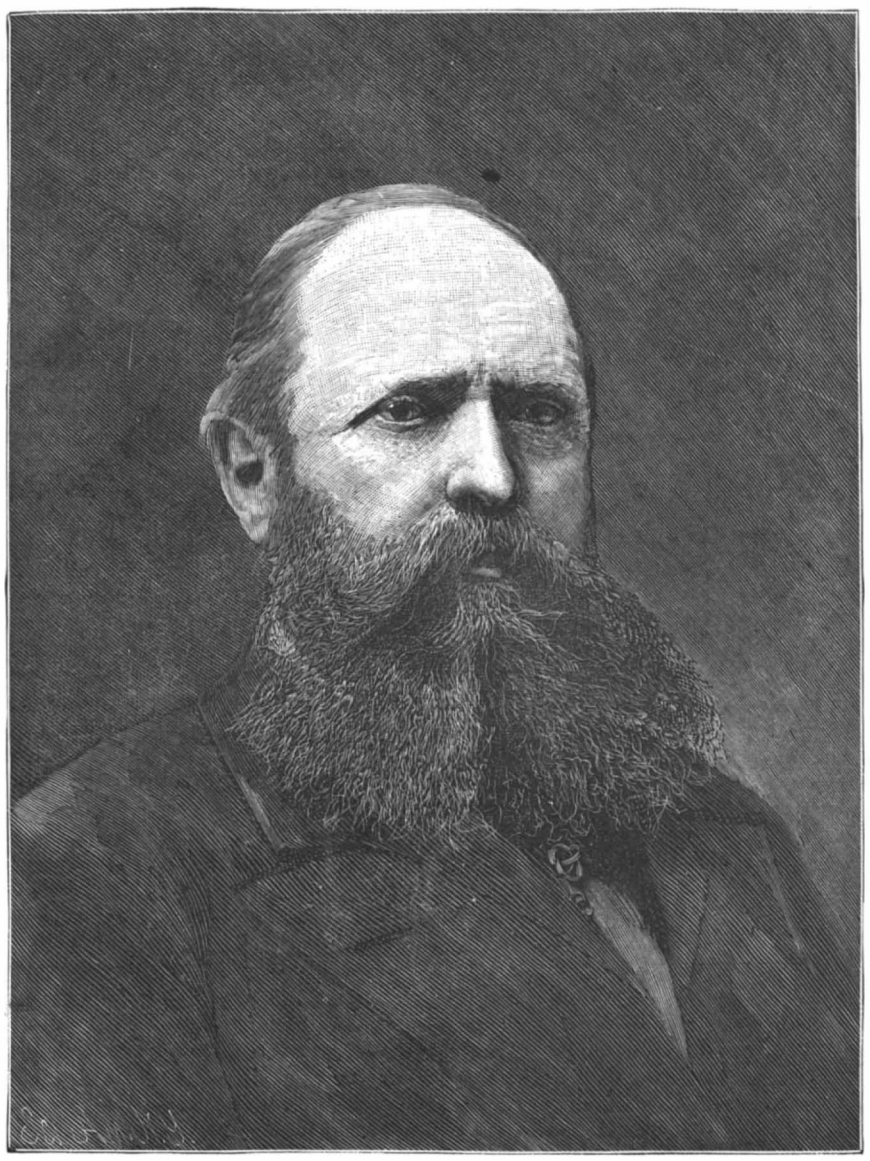
In 1866 he returned to this country and was appointed Professor of Paleontology at Yale University, and retained the professorship until the time of his death. The fund which endows it, as well as the endowment of the Peabody Museum of Natural History at New Haven, Conn., the Peabody Museum of Archæology and Ethnology at Cambridge, and the Peabody Academy of Science at Salem, Mass., comes from the estate of George Peabody, his uncle.

Prof. Marsh began the work of his professorship by the examination of the cretaceous and tertiary fauna of New Jersey, and in 1868 he made the first journey to the region with which his name is most fully identified —the Rocky Mountains. He led various scientific expeditions to this then little known country, and in these researches he crossed and recrossed the Rocky Mountains between twenty and thirty times, and penetrated regions which had never been before visited by white men, encountering much danger and enduring great hardships. More than once he required the protection of the United States troops against the assaults of hostile Indians. The Yale exploring party of 1870 discovered over a hundred new species of extinct vertebrates, most of them from two newly discovered tertiary basins. Among the more important of these discoveries were a new sub-class of birds with teeth, the first known American pterodactyls, two new orders of large mammals of elephantine bulk, with horned cores on their skulls, specimens of the earliest known ancestors of the horse, the monkeys, bats, or marsupials, ever found in this country, and a number of several new families of dinosaurs. Some of these reptiles were the largest land animals ever discovered. All of these became the property of the Peabody Museum at Yale. Probably his most startling discovery was that of the fossil ancestor of horses—the cohippus—as large as a fox, with four toes and the signs of a fifth on the fore feet and three toes on the hind feet. In 1876 Prof. Marsh began preparing monographs describing his discoveries, and more than three hundred of them have appeared in The American Journal of Science and in the publications of the United States Geological Survey, the last to appear being "The Dinosaurus of North America," in 1896. Naturally, Prof. Marsh was the recipient of many honors, both at home and abroad.

Prof. Marsh has left his entire estate to the University. It is thought that it will amount to $150,000. Prof. Marsh gives to Yale his residence and his spacious grounds for a University botanical garden. The National Academy of Sciences is to get $10,000; and 2,000 orchids belonging to Prof. Marsh are left to the University. It is said that his scientific collections referred to below were worth in the neighborhood of $1,000,000.

Prof. Marsh will be best remembered at Yale by his magnificent gift made in January, 1898. For years he had been collecting a valuable series of examples of vertebrate and invertebrate fossils from all over North America, the collections numbering many thousand individual specimens. These were presented to Yale University January 15, 1898. The entire collection really includes six individual collections. The first were vertebrate fossils, the most important part of the gift. Prof. Huxley stated in 1876 that this was the greatest collection of the kind in the world. Second is the collection of fossil footprints, taken mostly from the region of Connecticut Valley. The third is that of the invertebrate fossils. The fourth in the series is recent osteology. The two remaining collections are of American archæology and ethnology, as well as a fine collection of minerals.

The news of Prof. Marsh's death was a great shock in university circles, and the loss to American science by his death is almost incalculable. His researches in pure science will never be forgotten.



THE LATE OTHANIEL CHARLES MARSH.

A Singular Bequest.

It has been stated that John Walter, of The London Times, left as a legacy to his daughter one of the advertising columns of the Thunderer. It brought the lady a steady income of $150 a day —enough to keep her from poverty.

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Novelties for the Paris Exposition.

If the management of the Paris Exposition fulfills its promises, no small number of technical marvels will be revealed to the public in 1900. First of all there will be Sczepanik's much heralded telectroscope, an instrument which, by the aid of selenium, is said to have solved the problem of electrical vision. The telectroscope will, however, find a rival in the telautograph invented by Anton Pollak, a Hungarian engineer. The telautograph, it is claimed, provides a means of receiving messages sent from one station to another, in exactly the same form in which they were transmitted. The idea in itself is old; but the inventor is said to have devised an apparatus which is entirely different from its predecessors. Pollak claims to have solved the problem by using selenium—a metal which is unique in possessing the property of conducting electricity with a resistance which varies with the intensity of the light that falls upon it. The varying illumination is produced by treating the written telegram in a peculiar manner, and the variations in resistance effected by the selenium are communicated to a conductor to produce an increase and decrease in the intensity of the current passing therethrough. According to Uhland's Wochenschrift, the Vereinigte Elektricitäts-Actiengesellschaft, of Budapest, has applied to the management of the Exposition for space in which to exhibit the apparatus. An imperfect model is said to be in tolerably successful operation, and to be able to transmit in one hour 144 telegrams, each four inches by two inches, upon which space any number of words or characters can be inscribed.

Houdin and the Arabs.

Probably the most interesting personality in the whole history of magic is Robert-Houdin. His interesting works on magic are classics, and are so regarded by all conjurers. Rarely has a more fascinating biography been written than his "Memoirs." The crowning event of Houdin's life was when he was sent to Algeria to counteract the influence of the marabout priests over ignorant Arabs. The marabouts are Mohammedan miracle workers and were continually fanning the flames of rebellion against French domination. The French government invited Robert-Houdin to go to Algeria and perform before the Arabs in order to show them that a French wizard was greater than a marabout fakir. This was pitting Greek against Greek. The marvels of optics, chemistry, electricity, and mechanics which Houdin had in his repertoire, coupled with his digital dexterity, were well calculated to evoke astonishment and awe. How well the French wizard succeeded in his mission is a matter of history. A full account of his adventures among the Arabs as contained in his "Memoirs" makes very interesting reading. The Household World recently published the following account of his early experiences in Algeria:

To witness Houdin's first performance in Algiers the neighboring tribes were invited. The theater was speedily filled with them and the French officials, who attended in all their pomp and glory. Interpreters were scattered through the house in order to repeat Houdin's remarks to the natives in their own language. With true Oriental dignity and gravity, the Arabs witnessed the first few tricks in stolid silence, but the taking of a huge cannon-ball from a borrowed hat aroused great excitement.

Then came the great tricks of the evening, especially prepared to astonish the Arabs.

"By a wonderful power which I possess," said Houdin, "I can deprive any man of his strength. I invite anyone to prove my words."

On this being interpreted to the Arabs, a tall, strong man stepped forward on the stage. Houdin held in his hand a little iron box, and, balancing it carelessly on his little finger, he asked the Arab,

"Are you strong?"

"Yes," replied the man carelessly.

"Are you sure of always remaining so?"

"Always."

"Lift that box."

The Arab did so, and asked contemptuously, "Is that all?"

"Wait!" said Houdin, making a solemn gesture. "Now you are weaker than a woman. Try to lift that box again."

The Arab seized the handle and tugged again. He could not raise the box an inch from the floor. After many attempts, he paused for a moment to brace himself for a final effort. He seized the handle again, but shrieked aloud with pain, dropped on his knees, then, rising, threw his cloak round his face to conceal his shame, and rushed from the theater, leaving his compatriots stricken with fear. The trick was as simple as the result was startling. The box was placed on a powerful electro-magnet, and the current being complete, no man on earth could have lifted it. An electric shock, sent at a signal by Houdin from behind the stage, was what caused the Arab to shriek and hurriedly retreat.

Before the excitement caused by this trick had subsided, Houdin announced that he had a talisman which rendered him invulnerable, and he defied the best shot in Algiers to kill him. A marabout at once sprang on the stage, exclaiming, "I want to kill you!" Houdin handed him a pistol, which the Arab, examining, pronounced a good one. "It is a good pistol, and I will kill you."

"Very well," said Houdin. "To make sure, put in a double charge of powder. Here's a wad. Take a bullet from this tray, and mark it so you will know it again. Ram it into the pistol well."

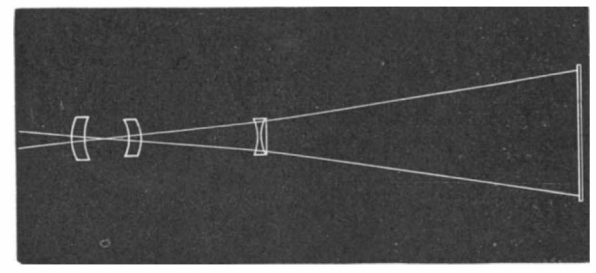
"It is done."

"Now," said Houdin, "you say the pistol is a good one, and you've loaded it well, so kill me."

"Yes," replied the marabout; "I will do that."

Houdin took a pear, stuck it on a knife, and walked a few paces in front of the Arab, and told him to aim at his heart. He fired, and the marked bullet was seen on the pear. After the powder and wad were rammed home, and while the Arab was marking the bullet, Houdin slipped a little tube into the pistol. This tube was closed at the lower end, and into this the Arab dropped the bullet. As he thrust the wad down with the ramrod, the tube fitted snugly on to it, and was withdrawn with it, being polished to resemble it. Houdin thus got possession of the marked ball, and all was then plain sailing.

On one occasion during his visit to Algiers Houdin was placed in a very awkward position, from which he only extricated himself by his quick-wittedness. He was the guest of an Arab chief, Abou Allem, and entertained his host and friends by a few tricks. One of the company was a marabout, who asserted that the spectators in Algiers had been merely duped by a vision. Houdin, however, produced the marabout's watch in his hand, and, on feeling his sash, the marabout found there a five-franc piece. Convinced by this and other feats that Houdin was really a sorcerer, he challenged him to repeat his performance in the theater and produced two pistols. "You need not fear," said the Arab, "since you know how to ward off bullets." Without losing his self-possession, Houdin explained that his invulnerability lay in a talisman which was with his possessions in Algiers. "By six hours' prayer, however, I can do without that talisman, and at eight o'clock to-morrow morning you can fire at me."



COURSE OF THE RAYS THROUGH THE TELEPHOTO.

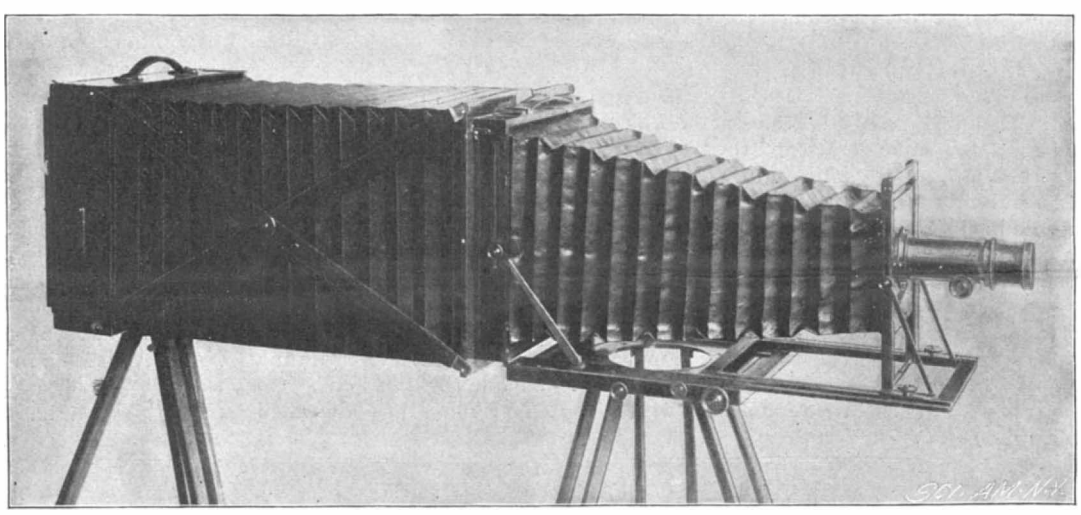
At the appointed time there was a large concourse of Arabs, which the news had attracted. The pistols were brought and carefully examined. The marabout dropped in the powder, Houdin handed him a bullet from the tray, and he rammed it down. Houdin then loaded his own pistol, and, walking about fifteen paces away, turned and faced the marabout. The shot was fired, and the Frenchman opened his mouth and showed the bullet between his teeth. "You could not kill me," he said, "and now you shall see what my shots can do." He fired at the marabout, and immediately a red splash was seen on the whitewashed wall before which he was standing. The Arab was untouched; stepping up to the wall, he dipped his finger in the red splash, tasted it, and realizing that it was blood, collapsed in amazement.

Though the trick was simple, only a Houdin could have devised and carried it out successfully. During the night he had melted some wax, blackened it to look like lead, and ran it into a bullet mould, thus obtaining a hollow globe of wax exactly resembling a bullet in appearance. It was with this bullet the marabout loaded his pistol, and in ramming it down crushed it to powder. A second bullet, similarly made, Houdin filled with blood obtained from his own body. This he dropped into his pistol, and rammed it down very gently, so as not to crush it. As it struck the wall it was broken, leaving a red splash of blood.

TELEPHOTOGRAPHY.

Every photographer has seen opportunities for making desirable photographs when distance interposed an insurmountable obstacle; for example, it may be desired to photograph a group of cattle in a field, which would be scattered on the approach of a human being, or a distant but inaccessible mountain which could only be seen to advantage from a neighboring hill, or a bit of scenery on the further side of a river or lake, and hundreds of other scenes which attract the eye of the photographer, but which are practically beyond the reach of his instrument without the device described in this article, by means of which the object may be brought into such close proximity as to make the work of the photographer very easy.

Given a distant and inaccessible object, the necessity for a photograph, and a photographer desirous of producing such a photograph, and we have all the conditions for the practical use of the telephotographic attachment herewith illustrated. This is not a telephotographic objective, but an achromatic negative combination to be attached to an ordinary photographic lens to amplify the image produced by the lens from three to eight diameters, thereby representing the object at from one-third to one-eighth the distance shown by the lens without the attachment; in other words, it enables the operator with a photographic lens to obtain a photograph of an object on a much larger scale than can be obtained with the lens alone without the telephotographic attachment.



CAMERA WITH TELEPHOTO ATTACHMENT, ADJUSTED TO MAGNIFY SEVEN TIMES.

During the late war with Spain, the desirability of procuring photographic negatives with the aid of a telephotograph became very apparent. Mr. Dwight L. Elmendorf, of New York city, who has made a special study of this method of photography, followed the campaigns in Cuba, both on sea and land, and with the aid of the telephotographic camera obtained some remarkable photographs of troops in action. Many of these photographs were taken at a great distance from the scene of action, so that the photographer was in comparative safety while engaged in taking the views. The results obtained, however, do not justify this supposition, as, from all appearances, the men appear to be in close proximity to the camera, and one would judge that the intrepid photographer was having a hot time of it. There are immense possibilities of a very practical nature in the use to which this method of photography can be put, and it should prove of great value in warfare in determining the nature of the enemy's country, in making observations of special objects and fortifications, and in obtaining a record of the positions of troops while maneuvering or in action, while they are at a considerable distance.

We give an example of the work that may be obtained by the use of the telephotographic attachment. The smaller picture is a view of a large summer hotel in Maine, which was taken on an 8 × 10 plate with a rectilinear lens. The small space inclosed by the parallelogram contains what appears on the larger plate magnified seven times. Both views were taken from the same point, one with the photographic lens alone, the other with the lens provided with the telephotographic attachment adjusted to magnify seven times. This attachment is of great utility in taking views with even much less magnification than that here shown. It is very useful in making pictures of buildings, especially high and inaccessible portions, as it permits the operator to take the view from a point far enough away to avoid the distortion common to pictures made with the lenses of wide and medium angles.

The attachment is shown as applied to a Zeiss anas-

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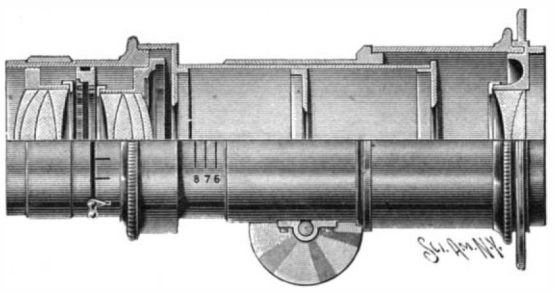
tigmat 6½ × 8½ lens on an 8 × 10 box provided with an extension, to enable the parts to be adjusted for a magnification of eight times. This necessitates a camera box 42 inches long, requiring the use of two tripods. The extension on the back of the camera box is 22 inches in length, and is used fully extended only for magnifying six, seven or eight times. For making views with a magnification of three, four or five diameters the rear bellows is closed, and the apparatus is supported on a single tripod.

The telephotographic attachment represented in one of the engravings with a Zeiss objective inserted in the outer end is shown partly in section, to more clearly illustrate the construction. The rear or flanged end of the attachment contains an achromatic negative or concave lens which corresponds to an amplifying lens in a microscope or telescope. To the tube containing this lens is fitted a sliding tube, in the front end of which is placed the photographic lens proper. The sliding tube is adjusted by means of a rack and pinion, the latter being turned by the milled wheel.

As the amplifier magnifies any imperfections that may be in the lens to which it is applied, it follows that none but the finest lenses can be used in connection with the attachment. It has also been ascertained that it is necessary to have the negative lens fitted to and corrected for the photographic lens with which it is used. After the rays cross in the photographic lens and diverge within the camera, the central ones are rendered still more divergent by the achromatic concave lens taking the course shown in the diagram. It will be seen that only a small portion of the rays received and transmitted by the photographic lens pass through the amplifying lens. The time of exposure is, of course, much longer with the telephotographic attachment than with the photographic lens alone; that is, it is approximately proportional to the square of the magnification. For example: If, with the photographic lens alone, the exposure would be $\frac{1}{64}$ of a second, with the telephotograph adjusted to magnify eight times, it would require an exposure of one second; but there is considerable latitude in exposure in a telephotograph, and it is well enough to give a little more time than the rule calls for.

The principles underlying the use of the camera for this kind of photography are so simple that there is no reason why any one having any taste for photography should not quickly become accustomed to its manipulation, with results that will be found most novel and gratifying. The expense is trifling, as the ordinary camera and lens may be used, the extra length being obtained by means of the box extension at the back of the ordinary camera. This box extension is clearly shown in the engraving. Of course, owing to the length of the complete apparatus when assembled for telephotographic work, two tripods are necessary. We present in one of the views a detail of the telephotographic attachment and a diagram showing the path of the rays before they reach the plate as indicated above. The whole subject is teeming with interest for the amateur photographer, and the most interesting and startling results are often obtained.



PHOTOGRAPHIC LENS WITH TELEPHOTO ATTACHMENT.

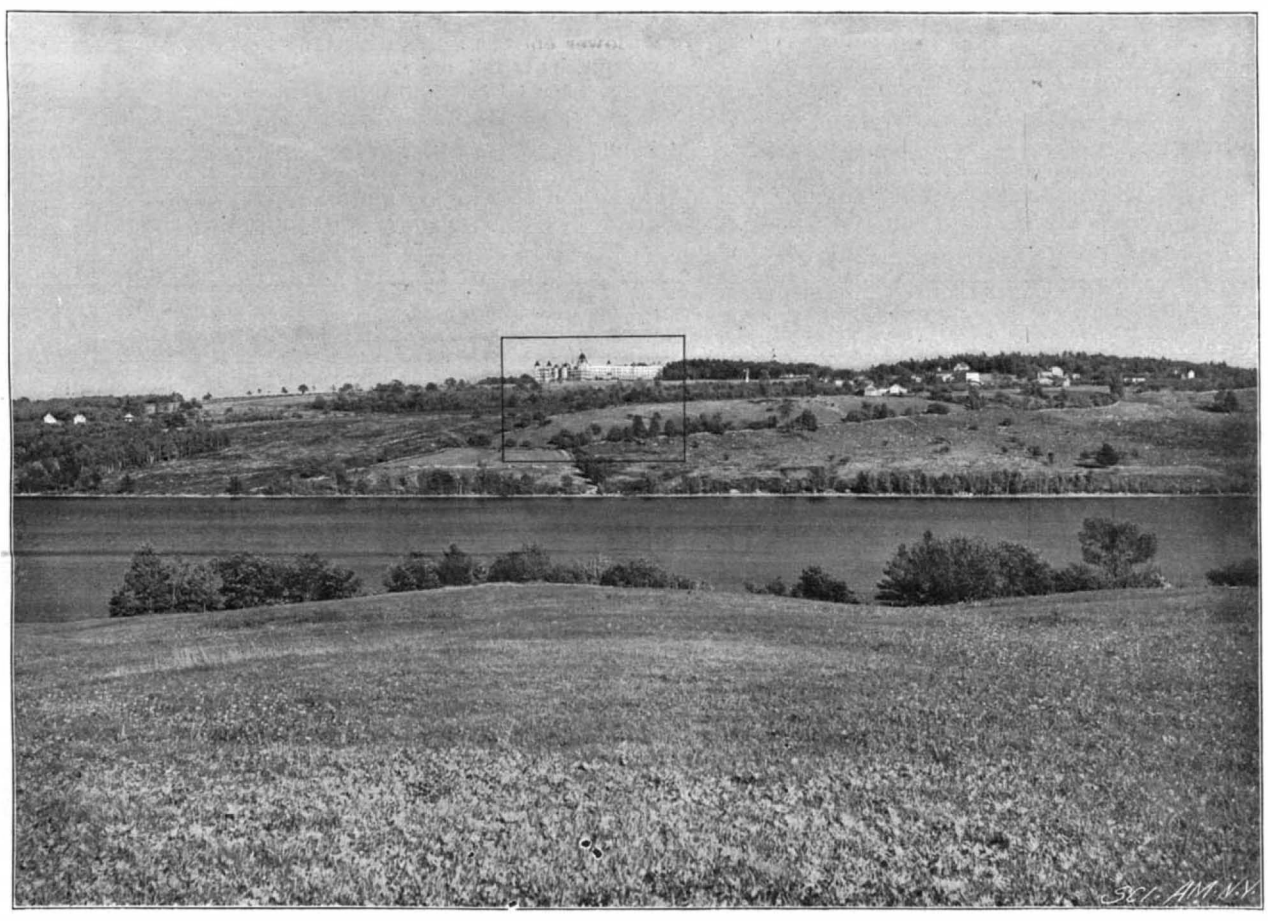
Breathing Valves of Fishes.

Fishes breathe, as is well known, says Ulric Dahlgren, in The Princeton Bulletin, by passing a stream of water through the oral cavity, in at the mouth and out by two lateral openings, the gill clefts. This is accomplished by a rhythmic motion, plainly visible, the nature of which, however, has never been accurately described, our best text-books of ichthyology calling it "swallowing," "An act similar to swallowing," etc.

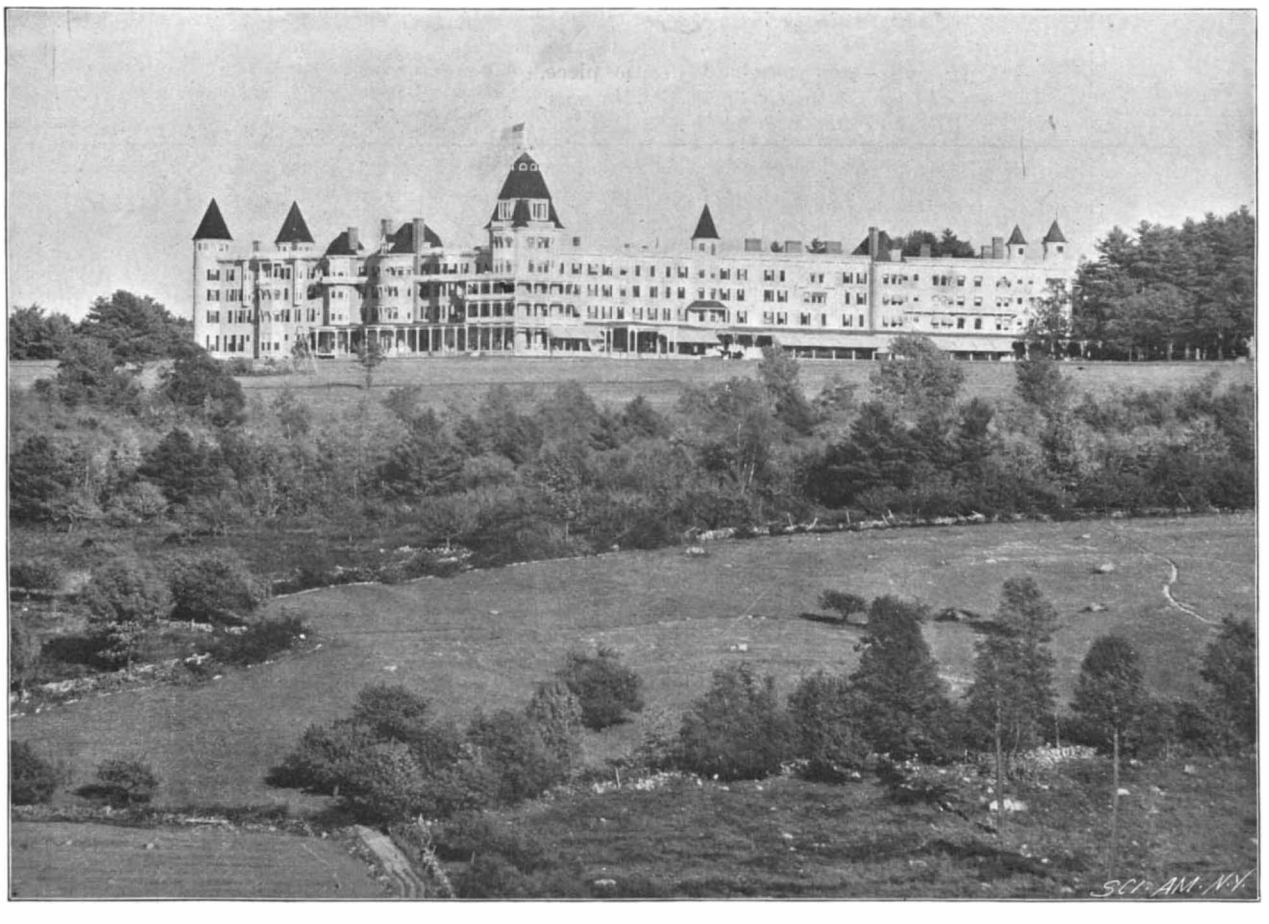
The writer's discovery of two membraneous valves just inside the teeth has made possible the following conception of the breathing of teleost fishes.

The construction and operation of the fish's apparatus is that of a perfect two-valve pump. In such a pump there must be a chamber which possesses two openings, each guarded by a valve. The forces necessary to operate such a structure are three (or six) in number: 1st, a force so applied as to alternately contract and expand the chamber; 2d, a force to alternately shut and open the posterior (exit) valve; 3d, a force to alternately shut and open the anterior valve. These valves must be operated in proper sequence to the expansion and contraction of the chamber. The valves may be operated either by separate mechanism or by the automatic action of a current passing through the chamber.

It is to this latter point that attention is called in the case of the fish. Here we find a chamber (the oral cavity) and two openings, the mouth (anterior opening) and the double gill opening (posterior opening). Muscular force is applied to expand and contract the oral cavity. But no such direct application of muscular force is needed to open and close the anterior and posterior openings. This is done automatically by the branchiostegal valves in the gill opening (or posterior opening), and by the maxillary and mandibular breathing valves in the mouth opening (or anterior opening). The fish is thus not required to use separate muscles to close and open the passages, but the loss of energy due to friction and retarded momentum on the valves must be added to that required to expand and contract the oral cavity. It is simply a mechanical economy such as is found in the heart.



A HOTEL IN MAINE PHOTOGRAPHED WITH ORDINARY LENS.



PHOTOGRAPH OF SAME BUILDING FROM SAME POINT WITH TELEPHOTO ATTACHMENT, DISTANCE NEARLY TWO MILES.

Work on the Public Library.

At the recent meeting of the Board of Trustees of the New York Public Library it was announced that the Board of Estimate and Apportionment would probably be able to appropriate $1,000,000 for the work on the New York Public Library during the present year, and $500,000 thereof is now immediately available, by reason of an appropriation made March 17, for removing the reservoir and making the foundations. The work on the library has been delayed for a long time, owing to the real or supposed approach of the city to its debt limit. However, there has really been no time lost, for the interval since the adoption of the plans has been most valuable as giving an opportunity for their study and development. Since July, 1896, about 80,000 volumes and 80,000 pamphlets have been added to the collection of the library, and at the end of the present year the library will contain about 465,000 volumes and 180,000 pamphlets. To accommodate the great increase, nearly five linear miles of shelving have been built, of which nearly one-half has been placed in the Lenox Library building.

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Correspondence.

A New Plan of Education.

To the Editor of the Scientific American:

The sketch I gave of a plan to promote international correspondence and mutual help, that you kindly inserted in the Scientific American of January 14, 1899, has brought me many very sympathetic comments from your readers and more inquiries than I know how to answer, unless you can find a place for this letter in your correspondence columns. I shall try to condense my reply as much as possible.

First: No such an association as I propose yet exists; whether it ever shall be realized depends entirely on the reception this idea meets with generally. If such an association is really as useful as I believe it to be to thousands of intelligent people all over the world, it will certainly appear, grow, and become as common an institution as the post office. If the time is not ripe for it, it will have to wait. I am the last man to know anything about that.

Second: I am quite alone in this, and have neither the time nor the means to work out the plan single handed.

Third: Since many correspondents ask me where the money is to come from, I must have failed to explain that the very pith of the plan is that no capital is needed to run it. All is based on mutual service. A comparatively small sum must be collected to pay for work in drawing up the programme, printing and posting the lists of associates, etc., these expenses to be covered by sale of lists at a moderate price. Once started, the bureau should soon become self-supporting.

Finally: My idea of commencing the business was as follows: In each of the greater countries a newspaper or journal that would lend its temporary assistance to the plan would request people who were universally known in their country (statesmen, authors, artists, capitalists, etc.), and who approved the proposed association, to send their names and addresses to the editor. A list of these names would then be sent to each of these gentlemen, with the request to name one representative, the one who received the most votes to be the representative of his country. In case of refusal, the next, etc. Once elected, the representatives of all countries, perhaps 12 or 15 in all, might arrange the time and place of meeting, say at the Paris Exhibition. This meeting to nominate a board of three or more persons, at their choice, who would constitute the central bureau mentioned in my paper. Immediately on being nominated, the bureau would commence work, i. e., draw up and publish the circular, elaborate a programme, etc.

This co-operation of universally known men would be invaluable, as it would immediately place the whole scheme on a serious footing and earn for it the confidence of all people. At the same time, I fail to see on what grounds we could expect them to refuse their assistance. The plan is in no way a speculation or commercial enterprise—rather a kind of mutual education and assistance scheme. The trouble would be limited to writing and sending two cards to a newspaper, the first containing writer's name and address; the second, name of representative. The work of the representatives on meeting each other would also be limited to the organization of the central bureau. When matters would have reached that point, I think it would be an easy matter to realize the small capital necessary to commence work.

A last word. Some correspondents tell me that it would be unreasonable to expect special or detailed information free of all charge. Evidently; nor do I think there can be two opinions on that point. But as things stand at present, most of us do not know where to ask for the reliable information that we are quite willing to pay for.

N. Shishkov.

Simbirsk, Russia.

The Current Supplement.

The current Supplement, No. 1213, has many interesting articles, of which "The Nicaragua Canal" is undoubtedly the most interesting. This is a digest of a lecture delivered by Prof. Lewis M. Haupt, member of the Nicaragua Canal Commission, and revised by the author. It is accompanied by nine interesting photographs. "An English View of the Spanish-American War" is a timely article. "The Production of Metallic Tubes by Extrusion" describes a new metallurgical process, by which all kinds of metallic sections, even of the most complex designs, are obtained by forcing metal melted to plasticity through a die under hydraulic pressure. "Trade Suggestions from United States Consuls" are particularly interesting in this number. The usual notes are also published, including a number of formulas for shoe dressings. "New Jersey Corporations" is an article describing that State's great income derived from corporations which come to the State because they are not excessively taxed. "The Patent Systems of the United States and Foreign Countries Compared" is by W. Clyde Jones. "The North American Porcupine" is an interesting article by Dr. G. Archie Stockwell.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CHECK-ROW CORN-PLANTER. — Charles H. Baker, St. James, Mo. The invention provides a machine which is capable of varying in an effective and simple manner the distance between the points at which the corn is dropped. The mechanism includes a rotary feed-wheel and means for imparting a continuous rotary motion thereto. A rotatable drop plate is mounted below the feed-wheel and is provided with means for imparting an intermittent motion thereto, and with means for varying the length of each movement thereof. The invention, it will be observed, embodies a new method of regulating the movement of the drop-plate. By reason of this construction, the intervals between the drop pings can be varied as desired, it being also possible accurately to measure the exact adjustment of the parts necessary for any given distance between the droppings.

Bicycle-Appliances.

DEVICE FOR TRUING WHEELS. — John G. Schmidt, Portland, Ore. This truing device for bicycle-wheels has a body-plate with a fixed and an adjustable jaw adapted for engagement with the forks of the bicycle-frame. An adjusting-bar is pivoted on the body-bar and extends below the jaws and beyond the body-plate. A truing-point is carried by the body-plate, and a second truing-point is adjustably located on the adjusting-bar to take eccentric deflection off the wheel. The device is of such size and form as to permit its being carried in a tool-bag.

Engineering-Improvements.

ROTARY ENGINE.—William H. Wilson, Hinton, W. Va. The engine has two rotary exhaust valves which have a link connection. These valves are each directly connected with oscillating pistons which are operated by steam led to them from the main inlet ports of the engine. These main ports are two in number—one for forward motion and one for reversing. They are opened and closed by a valve consisting of two concentric tubular segments, fitting one within the other and operated by a single lever connected with them on the outside.

Mechanical Devices.

CARDING-MACHINE.—Alexandre Vinchon, Roubaix, France. The ordinary method of cleaning wool in carding machines, by means of the picker roller, gives imperfect results, because the wool is very slightly divided, and because it becomes entangled by large fibers, thus hiding and retaining in the wool, burs and other impurities. The object of this invention is to overcome these two defects by placing directly behind the picker roller a cleaning-roller having rows of fine teeth arranged longitudinally around its periphery. These teeth open out the fibers and expose the burs, which are then removed by another picker-roller without injuring the fiber.

COIN-CONTROLLED VENDING-MACHINE. — William Tribble, Alton, Ill. This machine is intended for the automatic vending of cigars. The cigars are placed in a box in the top of the machine. They are arranged with a ribbon running back and forth between the layers, so that when the ribbon is wound off on a reel the cigars are displaced one at a time and fall into slots in a delivering roller, which turns and drops them in a chute. The machine is so constructed that it may be set to deliver two cigars or more at a time if desired.

SINGLE TRIGGER FOR DOUBLE-BARREL FIRE-ARMS.—Peter C. Koll, Walnut, Iowa. The invention provides a single trigger which may be used with perfect safety for two hammers, and which is constructed so that the right-hand hammer will drop first without the possibility of the left-hand hammer's being brought into action. Upon pulling the trigger a second time after the first firing, the left-hand hammer will be operated. Novel means are provided for safely lowering the hammers when cocked and when the gun is opened, this result being attained mainly by the forward movement of the trigger. If, however, the hammer be cocked and the gun closed, the hammers can be dropped by firing, the trigger being locked against forward movement.

Miscellaneous Inventions.

ENVELOP.—Jacob Schaub, Salt Lake City, Utah. This invention seeks to provide an envelop which cannot be opened without detection. The improved envelop is provided with a bottom flap having an inward fold forming a pocket, with two side flaps overlapping each other and the bottom flap, and separated at their lapped ends by a narrow space, so as to permit the tongue of a mucilaged sealing-flap to enter the pocket. The envelop is of especial service in the sending of second class matter through the mails.

HOSE-COUPLING.—Henry O. Paul, Clear Lake, Iowa. One of the two sections of this coupling is formed with a conical, shouldered head, and with a second shoulder back of the first. The mating section is connected with the first section by means of a collar, the rear shoulder previously mentioned being located within the collar. Locking-pawls on the collar engage the first shoulder of the first named section, and prevent the uncoupling of the parts. In order to make the coupling watertight, a cone-shaped washer is fitted on the conical shouldered head of the one section, between the two coupling sections.

WIRE-FENCE.—Lingue S. Morgan, Kendall, Kan. This invention provides a wire-fence whose longitudinal wires may be easily applied and locked to the posts or detached therefrom, and whose corner-posts may be readily adjusted to take up the slack of the wires, or to restore the posts themselves to their original vertical positions when they have departed therefrom. The fence-posts are notched to receive the wires and to hold them in place. In order that these wires may be still more securely locked, a spring-loop is provided which is adapted for engagement with the wire. The corner-posts of the fence are formed with a body portion comprising a flat inner plate, a V-shaped outer plate, and a flat-base. In order to adjust the post, an adjusting stay-rod, formed of two parts connected by a swivel-nut, and two shorter brace-rods with nuts applied to their ends, are employed. In adjusting the corner post, the swivel is rotated and the nuts turned on the brace-rods, until the desired position of the posts has been obtained.

CASKET-HANDLER FOR HEARSES. — William P. Fest, Rochester, N. Y. The improvement provided by the inventor for moving burial caskets to and from hearses, consists of a platform and bars designed as a permanent attachment to a hearse, and adapted to slide underneath the vehicle-body when not in use. By means of the device a casket may be easily lowered or raised.

DRESS-SHIELD HOLDER. — August F. Beese, Buffalo, N. Y. The purpose of this invention is to provide a device adapted readily to attach a dress-shield to the arm-scye of a garment, the attachment being so made that the shield may be quickly detached from the garment and another substituted. The device consists essentially of two parts: a gripping-section having two jaws, and a locking-section, the two sections coacting to hold the shield in place.

TELEPHONE DESK AND REGISTER.—Horatio F. Forrest, Brandon, Canada. The desk comprises a vertical backboard in which the desk proper is removably held. The desk is provided at its under surface with two rollers, one of which is adapted to pass through the core of a roll of paper, the other receiving the paper after it has been unwound. Two openings in the desk permit the paper to pass from one roller to the other over the desk, after the desired records, notes, or memoranda have been made.

PIPE-COVERING. — John A. Scharwath, Jersey City, N. J. The covering is especially designed for use on ammonia, brine, or other pipes, and comprises a split layer of waterproof material, surrounded by split rings, a split layer of felt held together by staples and surrounded by a tube, and a fabric the edges of which overlap and are held together by glue. The covering is designed to prevent the formation of frost on the pipe and the loss of cold.

CARTRIDGE-BELT. — Louis Sanders, Brooklyn, New York city. The novel feature of this invention is found in the use of a clamp comprising a box-loop fitted to embrace the belt-leaf and having opposite, connected arms arranged to be outwardly bowed. Spurs or prongs are arranged to be forced through the belt-leaf when the arms of the box-loop are readjusted to clamp the belt-leaf. The clamp is adapted to form pockets in the extension leaves of the belt, and to increase or decrease the diameter of a cartridge-pocket originally formed in the belt.

REPAIRING DEVICE.—George B. Leonard, Chicago, Ill. The purpose of the invention is to provide a repairing device for use on water-closet bowls, arranged to permit a quick connection between the water-supply pipe with the bowl, should the water-inlet be broken off. The device includes a thimble with a flaring end, means for drawing the thimble outwardly, and a coupling comprising two pivotally-connected links extended loosely through the flared portion of the thimble, the coupling serving to limit the outward movement of the thimble.

EGG-PRESERVING CRATE.—Benson H. Shearer and William O. Lewis, West Clarksville, N. Y. The body of the crate is so constructed that it will be surrounded by air and moisture-proof chambers, the air contained in the chambers or passageways serving to prevent the absorption of water by the eggs, thus keeping the eggs clear and bright. The lid of the crate is so made that, when placed in position, the eggs will be prevented from becoming tainted.

DOOR-HANGER.—Jackson D. Schooler, Sedalia, Mo. The hanger at its upper end is journaled on balls mounted to travel in a tube split to permit the passage of the hanger. The tube is supported on eyebolts, each having a shank and an open eye, the connection between the shank and eye being split. When each eyebolt is screwed up by means of a nut, the split portions are closed, thus causing the eye firmly to hold the tube in place. The hanger is especially designed for freight-cars, barns, and dwellings.

Designs.

CORN-HUSKER PAD.—Johann G. Kees, Nebraska City, Neb. Pads of this class are secured to the hand by straps and are provided with iron hooks to open the corn-husk. In the present pad, V-shaped end slots are made for the purpose of relieving the ends of the pad of undue stiffness, and also for the purpose of preventing wrinkling as the ends are drawn and bent around the hand. Slits are provided for the passage of the strap used to secure the pad to the hand.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS ETC.

The Elements of Physics. A College Text Book. By E. L. Nichols and William S. Franklin. Vol. I. Mechanics and Heat. New York: The Macmillan Company. 1898. 8vo. Pp. 218. Price $1.50.

The volume before us is the new edition, revised, with additions. The study of physics is an entirely different matter from what it was fifteen or twenty years ago, and the conditions call for new text books and systems of teaching. Now, when the student takes up physics, he must necessarily have a familiarity with mathematics, so that he can take hold of the matter intelligently from a mathematical standpoint. The present volume is admirably adapted for a text book where the knowledge of elements of the calculus is understood. Combined with supplementary lectures and laboratory work, the three volumes cannot fail to give the reader a most admirable knowledge of physics as understood and taught to-day.

American Trade Index. A Description and Classified Directory of the National Association of the Manufacturers of the United States. Arranged for the Convenience of Foreign Buyers. Philadelphia: National Association of Manufacturers. 1899. 12mo. Pp. 276.

The National Association of Manufacturers was formed in 1895, for the advancement of American trade. The membership of the association embraces 1,000 of the largest and most responsible manufacturers of the United States. It is a thoroughly representative organization, as its members are of all the important branches of industry and the principal producing sections of the country. A well equipped bureau of information is maintained by the association, and a great deal of good has already been accomplished by it. The association neither buys nor sells merchandise, and charges no fees for furnishing information. The classified list, which is before us, is a large American trade index, and will undoubtedly prove of great value.

The Evolution of the English House. By S. O. Addy, M.A. London: Swan, Sonnenschein & Company. New York: The Macmillan Company. 1898. 12mo. Pp. 223. 42 illustrations. Price $1.50.

We do not know of a more interesting subject than the evolution of the English house, in which we are more or less interested, because the English house is the prototype of our own. The volume before us deals with round huts, which were the earliest form of European houses, underground houses, rectangular houses, the town house, manor house, the castle, watch tower and church or "Lord's house." The author has treated a very difficult subject with marked success, and it is to be hoped that a large number of readers will appreciate his efforts. The volume forms one of the "Social England Series," and the only criticism we have to make regarding it is the totally unnecessary badness of the half-tone engravings, which are almost useless. It is a pity that such a scholarly and important book should been so badly made. It is accompanied by an excellent index, which is usually missing in books of this kind.

The Yarn of the Yampa. A Transatlantic Cruise. By E. L'H. McGinnis. New York: Outing Publishing Company. 1898. 16mo. Pp. 160. Illustrated.

This little book before us is admirably illustrated by half-tone engravings. The book is well worth reading, since it sums up in an entertaining way the account of the author's trip, and it gives good descriptions of many

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important things and places. We are afraid, however, that our sailor friends will find that the author has been somewhat loose in his use of nautical terms and phrases, as on page 31 and elsewhere, when he refers to the schooner as a "ship" [now a "ship" in its broad sense is a large seagoing vessel, and specifically a large vessel with bowsprit and three (recently also with four and even five) masts, each of which carries square sails; a "schooner" is a fore-and-aft rigged vessel of two or more masts], and of waves "striking us fairly and squarely aft of our quarters," which would amuse most sailors. On page 53 we find that every rope was "neatly flemished," which is, of course, improbable.

INDUCTIVE MASTER METHOD. German for Educated Americans, With or Without Teacher. Course of Seventy-eight Lessons for Thirteen Weeks, Fifteen Sentences Daily. Additional Selections of German Proverbs, Sayings, Quotations, Poems, etc. By A. L. Hermann. Minneapolis, Minn. Whole Course (Five Parts), $2.25.

Whatever may be the merits of this method of studying German, one thing at least is certain—it is assuredly unique. To teach a language by induction is, to be sure, no new idea; but the means whereby the author of the present system endeavors to impart this inductive knowledge are decidedly original. Each day's lesson consists of a typical German sentence, which is modified into fifteen different forms. A short key to pronunciation and a German proverb or poetical quotation conclude the day's lesson. At the end of the thirteenth week the student is supposed to have learned enough German to master Uhland's "Des Sängers Fluch."

QUICK AND EASY METHODS OF CALCULATING. A Simple Explanation of the Theory and Use of the Slide Rule, Logarithms, etc. By R. G. Blaine, M.E. London and New York: Spon & Chamberlain. 1898. 18mo. Pp. 144. Price $1.

Mechanical adjuncts in calculating are now almost a necessity, and of these the slide rule is probably the most important. The student, toiling along by arithmetical methods, can hardly fail to regard with wonder and admiration the ease and rapidity with which practically the same results are obtained by one expert in the use of this little instrument. A clear perception of the elementary principles on which the rule is constructed will enable the student to soon work out for himself satisfactory methods of calculating, and when he is once master of the slide rule and the use of logarithms, he will certainly never return to the clumsy methods which he formerly used.

KILBURN'S STANDARD HAND BOOK FOR RAILROAD MEN. By A. Kilburn. 18mo. Pp. 141. Illustrated. Price $1.

The present pocket book is intended for the use of railroad men, and it contains full information on the modern railroad locomotive and all its attachments, including air brake, air pumps, triple valve, brake pump governors, locomotive brake arrangement, pressure retaining valve, trainmen's signal valve, signals, switches, brake leverage, etc., also directions for operating and caring for all the parts. A set of questions and answers on braking, breakdowns, blocking, etc., are added. It is also claimed to be a valuable help in preparing for examination. A full set of double trip daily time sheets is also included.

ELECTROLYSIS AND ELECTROSYNTHESIS OF ORGANIC COMPOUNDS. Dr. W. Löb. New York: John Wiley & Sons. 1898. 12mo. Pp. 103. Price $1.

The field covered by the present volume is a broad and interesting one, and electricity, which possesses such a diversity of applications, has now obtained a recognized position in organic chemistry. The very nature of the subject suggested the possibility of solving synthetical and analytical problems by it which had, as yet, remained unanswered. The book aims to give as briefly as possible a review of what has already been accomplished, and at the same time to create an interest in the performance of experiments on the electrolysis and electrosynthesis of organic compounds.

NEUBAUTEN IN NORD AMERIKA. By Paul Graf. With photographic plates, plans and explanatory text, with a preface by K. Hinckeldeyn. Berlin: Hulius Becker. 1898. Price $1.50.

The number before us, like the other numbers which have preceded it, is filled with beautiful gelatine prints of prominent architectural examples in the country. They are admirably executed.

PHOTOGRAPHIC MOSAICS. An Annual Record of Photographic Progress. Edited by E. L. Wilson. New York: E. L. Wilson. 1898. 12mo. Pp. 286. Price 50 cents.

"Mosaics" is always a welcome visitor, dealing as it does in concise form with the very latest developments in photography. It is in many ways the most interesting photographic annual with which we are acquainted. The present volume is embellished with a beautiful collection of well-printed half-tone engravings.

THE AMERICAN SUGAR INDUSTRY. By Herbert Myrick. New York: The Orange Judd Company. 1899. Pp. 211. Price $1.50.

A practical manual on the production of sugar beets and sugar cane and on the manufacture of sugar therefrom lies before us. It is prefaced by a treatise on the economic aspects of the whole sugar question, and its bearings upon American agriculture, manufactures, labor, and capital, constituting a hand book for the farmer or manufacturer, capitalist or laborer, statesman or student. We have already published two illustrated articles on the manufacture of beet sugar, and we know, from the widespread interest which they awakened, that the subject is fast becoming of vital importance to the farmers of America. The volume before us is an admirable treatise, clear and to the point. The illustrations are excellent and numerous. It is a book which we can commend.

THE INTERNATIONAL ANNUAL OF ANTHONY'S PHOTOGRAPHIC BULLETIN. Vol. X. For 1898. New York: E. & H. T. Anthony Company. 1898. 8vo. Pp. 303. Price 75 cents.

The "International" is always a welcome visitor, and the volume before us, like its predecessors, is full of readable and valuable articles, which are beautifully illustrated. Without the several photographic annuals, a vast amount of important information would be almost wasted, for few can preserve many periodicals.

HOW TO MAKE AN INDICATOR. By A. C. Lippincott. New York: New York Publishing and Model Company, 1 Cortlandt Street. 1898. 24 pp. pamphlet. Price 75 cents in cloth, 50 cents in paper.

An admirable little publication, containing all instructions and working drawings required by an ordinary machinist to enable him to construct an accurate steam engine indicator, make and test the springs, all from material readily obtained in any locality. The high price of indicators has prevented many steam users from possessing them, but with a manual like the present, any mechanic can construct a reliable instrument, especially as the company supply materials, castings, and even partially finished instruments.

HAND BOOK OF METALLURGY. By Dr. Carl Schnable. Translated by Henry Lewis, M.A. Vol. I. Copper, Lead, Silver, and Gold. Vol. II. Zinc, Cadmium, Mercury, Bismuth, Tin, Antimony, Arsenic, Nickel, Cobalt, Platinum, Aluminum. London and New York: The Macmillan Company. 1898. 8vo. Pp. 876 + 732. 927 illustrations. Price $10.

It is a curious fact that there does not exist in the English language a single complete treatise on metallurgy. There are, indeed, a number of smaller text books, mainly adapted for the use of students, which cover the entire field, but make no pretension to describing it with any thoroughness or detail. Such being the position in regard to the literature of the subject, the translator has rendered the English-speaking metallurgist a distinct service in translating the most recent and exhaustive work on the subject in any language, from the pen of an eminent metallurgical authority. The book gives a complete account of the matallurgical treatment of every one of the metals ordinarily employed, together with the recent improvements in the art, not neglecting the scientific principles underlying each process; and it is illustrated by examples drawn from actual practice in various parts of the world. The author's travels have been extensive, which results in his experience being very great, and, of course, amply qualifying him for his task. After a careful examination of the two volumes, we feel we can safely say that it is one of the most important contributions ever made to metallurgical literature. The matter is so condensed as to be readily available, and there would have been no difficulty whatever in extending it over several additional volumes. The illustrations are numerous, well selected, and admirably executed, and serve to elucidate the text in an excellent manner. The index pleases us particularly.

A GUIDE TO THE STUDY OF THE GEOLOGICAL COLLECTIONS OF THE NEW YORK STATE MUSEUM. Albany. 1898. 8vo. Pp. 262, maps. Price 40 cents.

The University of the State of New York has just issued as Museum Bulletin 19, "A Guide," etc., by Dr. Frederick J. H. Merrill, director and State geologist. The bulletin aims to supplement the collections with such general information as cannot be given by cabinet specimens, and to direct visitors to reliable sources for more detailed information, since few persons have the preliminary training to enable them to obtain from the collections such advantage as they might receive if they fully understood their purpose and value.

MINERALS IN ROCK SECTIONS. Practical Methods of Identifying Minerals in Rock Sections with the Microscope. By Lea McIlvaine Luquer, C.E., Ph.D. New York: D. Van Nostrand Company. 1898. 8vo. Pp. 117. Price $1.50.

The work is specially arranged for students in technical and scientific schools, and the author's position in the Department of Mineralogy, of Columbia University, renders him particularly competent to deal with the subject. The identification of minerals in rock sections with the microscope, including as it does a knowledge of optical mineralogy, is often difficult for beginners, but the knowledge thus obtained is of the greatest possible value. Unfortunately, the most of the publications on the subject are in French and German, and they are usually entirely too confused in arrangement to be of much value to the student. For these reasons this text book has been prepared by the writer, with a view of putting before the students only those facts which are absolutely necessary for the proper recognition and identification of common minerals in the rock sections. A valuable table gives a scheme for the optical determination of common minerals in rock sections.

T SQUARE CLUB. Catalogue of the Architectural Exhibition. Philadelphia, January 14 to February 2, 1899. Pp. 224. 8vo. Price 50 cents.

The handsome volume before us is filled with superb reproductions of architectural designs and is worth many times its price as a study book for architects. The advertisers in the volume are many and its merit deserves their patronage, for the book is one to be preserved. The most important section, "An Unaffected School of Modern Architecture in America—Will it Come?" is a symposium of letters from celebrated American architects, such as Louis H. Sullivan, John M. Carrère, D. H. Burnham, Ernest Flagg, Russell Sturgis and others.

DICTIONNAIRE TECHNIQUE FRANCOIS-ANGLAIS DES OUTILS ET USTENSILES EMPLOYÉS DANS LES METIERS MANUELS LA PETITE INDUSTRIE, ETC. By A. S. Lovendal. Paris: Boyveau et Chevillet. 1899. Price 60 cents.

A book of this kind is always useful, as nothing is more difficult than to give the exact equivalents of tools in foreign languages. The only trouble is in understanding the classification. After that all is easy. The present dictionary will certainly prove of value.

BERG'S COMPLETE TIMBER TEST RECORD. By Walter G. Berg. Chicago: B. S. Wasson & Company. 1899.

This pamphlet is filled with valuable tables dealing with the strength of timber of all kinds. It will prove interesting to architects, inspectors of wood and construction, contractors, bridgemen, etc.

TESTING MILK AND ITS PRODUCTS. A Manual for Dairy Students, Creamery and Cheese Factory Operators, Food Chemists and Dairy Farmers. By E. H. Farrington and F. W. Woll. Madison, Wis.: Mendota Book Company. 1898. Pp. 256. 16mo. Price $1.

It is a thoroughly scientific treatise on the subject by competent professors of the University of Wisconsin. It is now in its fourth edition. The vital importance of a pure supply of unadulterated milk is recognized by sanitarians the world over, and they are given very substantial help by such a treatise as the present volume. It is fully illustrated and is written in a clear style.

HOW TO FRAME A HOUSE; OR, BALLOON AND ROOFING FRAMING. By Owen B. Maginnis. New York: Published by the author. 1898. Pp. 47 + 28. 8vo. Price $1.

This volume is an eminently practical book which will prove useful to all carpenters, houseframers and architects. It also includes full directions for framing the timbers for a brick house. The book is freely illustrated with well executed engravings.

TRIBUNE ALMANAC AND POLITICAL REGISTER FOR 1899. Henry E. Rhoades, editor. Published by the New York Tribune. Pp. 352. 12mo. Price 25 cents.

The Tribune Almanac has established an enviable reputation for the accuracy of its figures and for its general reliability. As a political register it is unrivaled.

FIFTH ANNUAL REPORT OF THE COMMISSIONER OF PUBLIC ROADS OF THE STATE OF NEW JERSRY FOR 1898. Trenton, N. J. 1898. Pp. 207. 8vo. Illustrated.

We are always interested in this report of the Commissioner of Public Roads, for, to a certain extent, New Jersey, which has such splendid roads and such atrociously bad roads, may be regarded as the experiment ground of the modern road builder. Some of the illustrations show the abominable conditions of the roads and the improvements which have been introduced in them. If the farmers could only be brought to realize the enormous value of good roads, the work of the Road Commissioner would be simple.

RECENT EARTH MOVEMENT IN THE GREAT LAKES REGION. By Grove Karl Gilbert. Washington: Government Printing Office. 1898. 8vo.

The pamphlet before us is an extract from the Eighteenth Annual Report of the United States Geological Survey, and contains a vast amount of scientific information on a little appreciated phenomenon.

ELEVENTH BIENNIAL REPORT OF THE KANSAS STATE BOARD OF AGRICULTURE. Topeka: Kansas State Board of Agriculture. 1899. Pp. 840.

When we look at the portly volume, which is larger than the Government Agricultural Report, we congratulate Kansas upon her prosperity. "What is the matter with Kansas?" is now only a memory, and, if nothing else were needed, the volume before us would demonstrate that there is nothing the matter with Kansas. We feel sure that the prosperity of Kansas is not grudged by her sister States.

THE LOCOMOTIVE UP TO DATE By Charles McShane. Chicago: Griffin & Winters. 1899. 8vo. Pp. 711. Profusely illustrated. Price $2.50.

The volume before us is of an encyclopedic nature and will certainly prove of value to locomotive engineers and those engaged in building or repairing them. The author acknowledges his indebtedness to a number of contributors from locomotive works and to mechanical journals. One particularly valuable feature of this book is its comprehensiveness; it seems to include everything which is connected with a locomotive and is really up to date. The arrangement is admirable and the illustrations are, many of them, the best we have seen. It would take more space than we have at our disposal to give even a brief outline of its contents. The book will be valuable even to those who already have the standard books upon the locomotive, such as those of Forney and Sinclair. The book is a large one for the money, and the purchaser will certainly find that he has received good value.

Natural Science. A Monthly Review of Scientific Progress. We have received the first few numbers of Natural Science, under the new management. It is now published in Edinburgh and London by Young J. Pentland. The valuable features which make this periodical so notable are continued, and it is very much improved in appearance. The quality of the original contributions is high, and the notes and comments, book notices, etc., show most careful editing. The subscription price, outside of Great Britain, is fourteen shillings per annum.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Gasoline Brazing Forge, Turner Brass Works, Chicago.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

Schwaab Stamp & Seal Co., Milwaukee. Send for cat'g.

Automatic Variety Wood Turning Lathes. H. H. Frary, Waterbury, Vt.

Small Accumulators. A new book. Illus. Cloth, 50c. Spon & Chamberlain, 12 Cortlandt St., New York.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 141 Varick St., N. Y.

Order White Metal and Brass Pattern Letters and Figures of H. W. Knight & Son, Seneca Falls, N. Y. Drawer 1115.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

The American Waltham Watch Company, of Waltham, Mass., have just published a thirty-six page illustrated brochure which treats of the perfected American watch, and is a dainty and beautiful product of the printer's art. The many illustrations are artistically arranged, and the book is inclosed in a handsomely embossed cover. The author has made a most entertaining book and conclusively proves that Waltham watches have earned for Americans the title of watchmakers to the world.

The book will be sent gratuitously upon application to the firm at the above address.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7626) G. K. asks: Where can I buy pure hydrogen? What degree of heat has the hydrogen flame? A. Any dealer in chemical supplies can furnish you hydrogen. It is very much cheaper to make it yourself, for which you can find instructions in text books of chemistry. Hydrogen is made by the action of hydrochloric acid on zinc. The temperature of an oxyhydrogen flame is variously estimated at from 4,000° to 4,350° Fah.

(7627) K. D. R. asks: 1. What is the size of the coils used in making the recording voltmeter described on page 455 of "Experimental Science"? Why are two needles used, the inner one swinging in the central opening in the coils, the outer one being located behind the coils, and what is the length of each needle? How much wire is wound on each coil? What is the resistance of both coils? If I wish to use the coils, needles, and index in a needle telegraph, would No. 22 wire be the right size to wind the coils? A. The working parts, coils, needles, etc., of galvanometer of "Experimental Science," page 455, are those of an astatic galvanometer. Three inches will do for the length and 1 to 1½ inches for the thickness of the spools. Two needles are used to render the system astatic. Make the needles 2 inches or so long. The winding of the spools would vary with the voltage current to which the instrument is to be used. 2. Do you publish in any of the back numbers of the SCIENTIFIC AMERICAN SUPPLEMENT an article on making a double needle telegraph? A. The needle telegraph is the subject of a chapter in Prescott's "Electricity and the Electric Telegraph," price $7.

(7628) F. A. B. asks: Does aluminum become extremely brittle when cooled to the temperature of liquid air or liquid nitrogen? And does the tensile strength of this metal increase at these temperatures? A. Aluminum is said to remain pliable when cooled to the temperature of liquid air. All metals have their tensile strength increased by cooling. Aluminum would be about twice as strong at 300° below zero Fah. as at the ordinary temperature.

(7629) G. F. W. writes: In a Sunday school room, an empty seat (with back) vibrates with the organ and even with the sound of a speaker's voice. How can I utilize the vibrations of the seat to telephone them to a distant point? A. You will not be able to transmit the music of an organ to a distance by means of a telephone and a seat in the rear of the room in which the organ is, for this reason: The seat does not take up all the vibrations of the organ, but only a small part of them. This is a case of sympathetic vibration. See Tyndall on "Sound," price $2.50; Zahm's "Sound and Music," price $3.50, by mail. It is possible to arrange a telephone transmitter so as to take up the rattle of the seat and transmit it, but is not worth while.

(7630) Reader asks: How can I make a battery, the exciting fluid of which shall be a solution of sal ammoniac, that will give a practically undiminished

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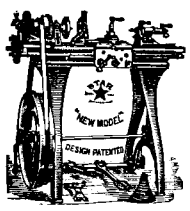

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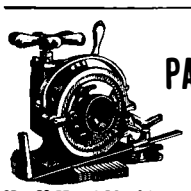

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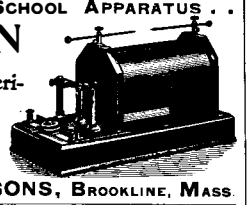

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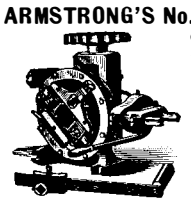

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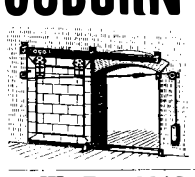

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1182.** Price 10 cents. For sale by MUNN & CO., 361 Broadway, New York City, or by any bookseller or newsdealer.

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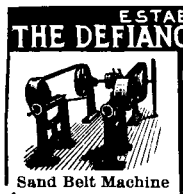

Sand Belt Machine

strength of current sufficient to operate for say an hour at a time? A. You ask the impossible. No sal ammoniac battery can run continuously for even a quarter of an hour without great reduction in the current. This is due to polarization, and cannot be avoided. If you wish a continuous service use a bichromate, an Edison-Lalande, or a gravity battery. The directions for making the bichromate battery are given in SUPPLEMENT, No. 792, price 10 cents.

(7631) L. A. D. asks: Is there any danger in amalgamating the zinc of the gravity battery in putting on the mercury too thick? Also, in making the regular Crowfoot do they add the mercury while melting the zinc, or do they rub the mercury on afterward? A. Only a film of mercury can be made to adhere to zinc. The rest you may put on will run off as water does. The mercury is combined with the zinc in the Carr composite zinc. These do not require amalgamating and can be bought of dealers in electric supplies. See advertising columns.

(7632) A. R. T. asks: Should the rubber plates of a sectorless machine be shellacked? A. Nothing is gained in shellacking the rubber plates of an induction machine beyond giving them a polished appearance and preventing the deposit of moisture upon them.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

MARCH 21, 1899,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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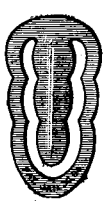

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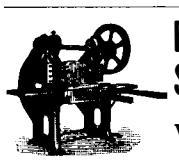

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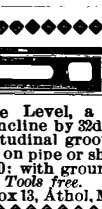

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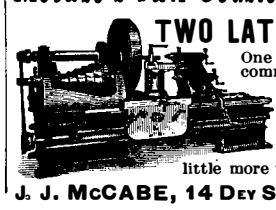

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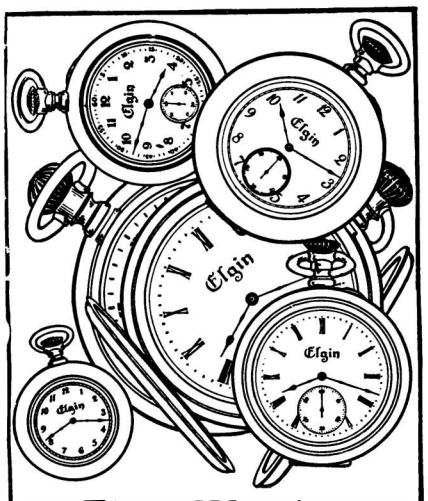

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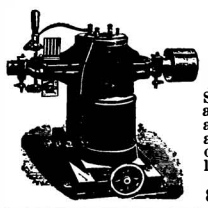

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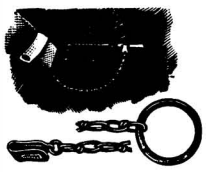

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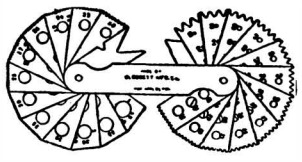

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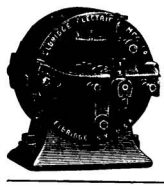

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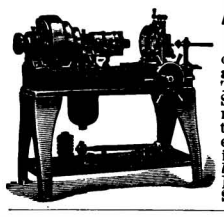

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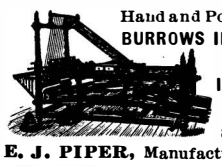

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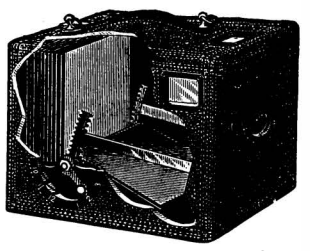

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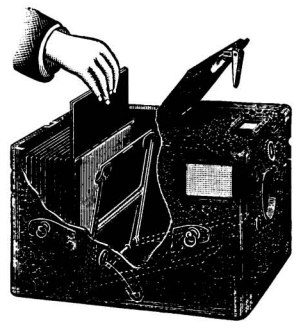

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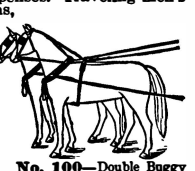

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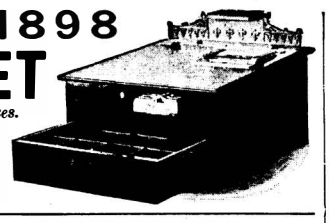

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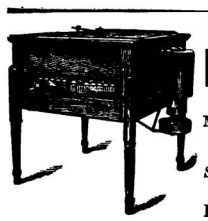

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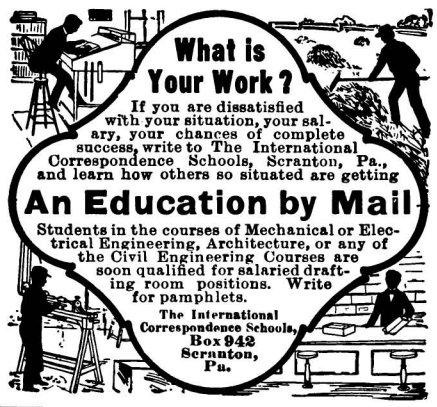

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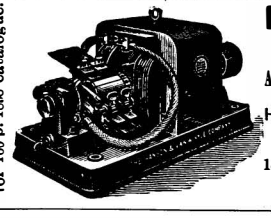

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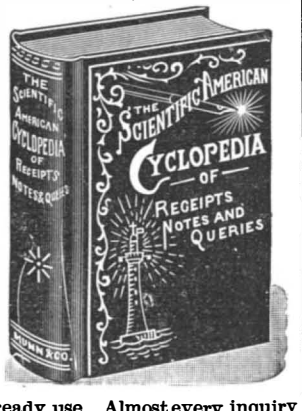

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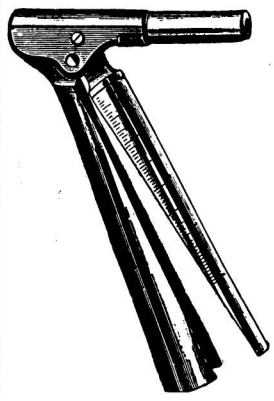

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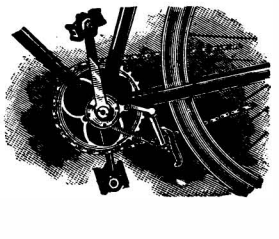

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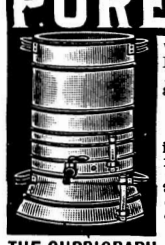

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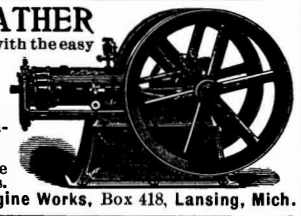

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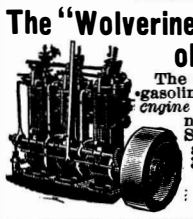

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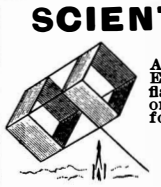

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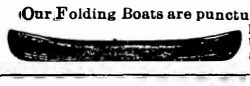

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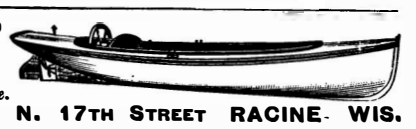

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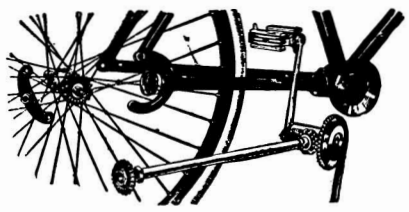

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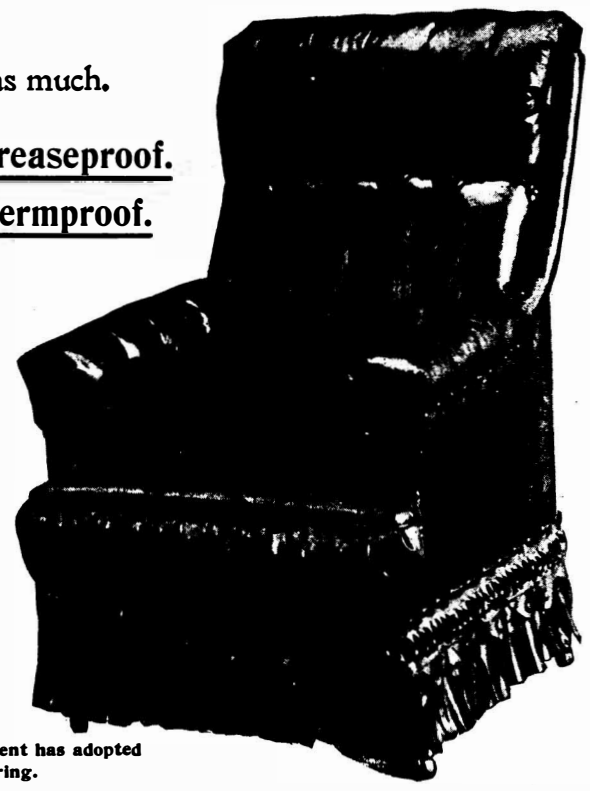

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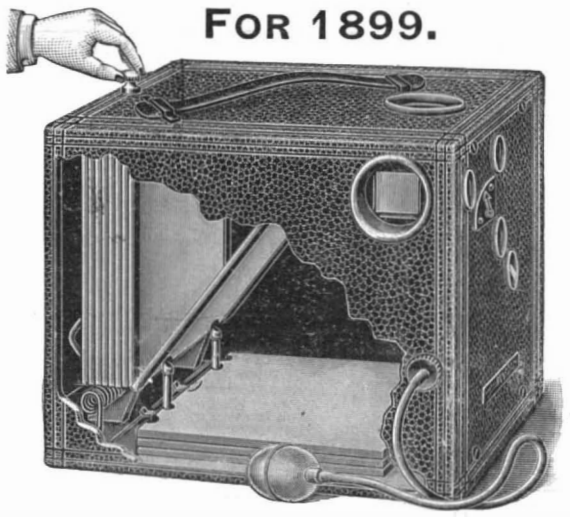

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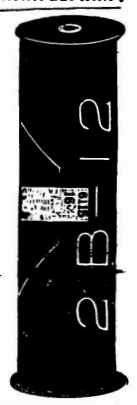

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